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# The Geographical Journal

Vol. LXIV No. 6 December 1924

## THE MOUNT EVEREST EXPEDITION OF 1924

*Joint Meeting with the Alpine Club at the Royal Albert Hall, 17 October 1924.*

### I. INTRODUCTION

**The Earl of Ronaldshay, President R.G.S.**

MANY of you who are present to-night were able to attend the beautiful Memorial Service held at St. Paul's this morning to the memory of Mallory and Irvine. Those who were prevented from doing so will wish to join in the tribute of admiration, affection, and respect which was then paid to the memory of these two men whose dauntless spirits refused to be bound by the fetters of their earthly bodies, and in that refusal found a glorious release. "We expect no mercy from Everest," declared Mallory after the climbers had been driven from Camp III. for the second time by abnormal weather. They received no mercy, and they died. But not, surely, in vain; for in dying they showed that the upward aspiring spirit of man, which will sacrifice all in its pursuit of an ideal, is a living and compelling force in determining the conduct of the individual, and equally therefore in shaping the destiny of the human race. I shall move no formal resolution of condolence, but will ask you to pay your tribute of respect in silence by rising in your places.

The story of the Mount Everest Expedition of 1924 will be told to you by those who actually took part in it—by General Bruce, who has the sympathy of all of us in his ill fortune in being compelled to relinquish the command by a temporary break-down in health; by Colonel Norton, who shouldered the responsibility of leadership with such conspicuous success; by Captain Geoffrey Bruce, who played so large a part in establishing those high-altitude camps upon which the success of any attempt to scale Mount Everest must necessarily depend; and by Mr. Odell, who was in support during the last great climb which ended in the loss of Mallory and Irvine. In these circumstances I need do no more than make bare mention of the outstanding achievements of the Expedition. The highest camp at which a night was spent during the attempt in 1922 was 25,000 feet; this year a

camp was established and nights were passed at 26,700 feet. In 1922 all previous records were beaten when Mallory, Norton, and Somervell without oxygen, and Finch and Geoffrey Bruce with oxygen, climbed to close on 27,000 feet and 27,250 feet respectively. This year these records have in their turn been beaten by Norton and Somervell when they climbed to 28,130 feet without oxygen, and by Mallory and Irvine when they reached 28,230 feet for certain and probably a greater altitude with oxygen. When it is remembered that these feats were achieved after the physical vigour of the climbers and the *morale* of the porters had been affected by two retreats to the base camp imposed by violent climatic disturbances—blizzards of snow accompanied by as much as fifty-six degrees of frost—the real magnitude of what has been accomplished becomes apparent.

Is the fight finished? Is the possibility of climbing Mount Everest to be left in doubt? Neither the members of the Expedition nor of the Mount Everest Committee are content to let the matter rest where it now stands, and it is our intention to apply immediately through the Government of India for permission from the Tibetan Government to make another attempt, possibly in 1926.

I will now ask General Bruce to begin the story.

## II. THE ORGANIZATION AND START OF THE EXPEDITION

**Brigadier-General the Hon. C. G. Bruce, C.B.**

I find that I am down to follow the President of the Royal Geographical Society both in my capacity as President of the Alpine Club and as the original leader of this year's Expedition.

As President of the Alpine Club I consider myself free to offer my warmest congratulations and to express my admiration to Colonel Norton and to the members of the Expedition, for his (Colonel Norton's) wonderful leadership, and to all for the heroic efforts which they all made. I must also express on the part of the Alpine Club the deep sorrow felt for the loss of two gallant members of our expedition who made their sacrifice in the most terrific effort of all mountaineering history. They were two magnificent personalities, and have the finest cenotaph in the world, and are worthy of that splendid monument.

Speaking now as the original leader of the Expedition, I must pass on to its organization. Colonel Norton, Captain Bruce, Mr. Shebbeare, and myself found ourselves in Darjeeling in the last days of February. There we found a large collection of porters, both true Tibetans and Sherpas, for us to choose from. We also found local supplies which had been ordered by our excellent agent Mr. Weathered, all ready for forwarding to Tibet. Our old interpreter and our old headman of porters were also ready to re-engage.

Owing to the experience gained on previous expeditions, and our exact knowledge of the geography of the district, and of where the high camps would be placed, it was found possible to earmark our stores for the different camps, so as to save time at our Base Camp. These arrangements were made by Norton and Bruce, and Shebbeare was despatched to Kalimgpong to take delivery of the stores and forward them on by our contractors into Tibet. All went swimmingly, and as soon as our whole party was collected, which was at the beginning of the last week in March, we were able to set out.

We marched in two parties in order not to overcrowd the rest-houses on our route, and collected in the beginning of April in Yatung. Certain arrangements had to be made there, but the party and its entire stores were gathered in Phari by April 5. We were a day earlier than in 1922, but experienced the whole way up an infinitely milder climate. Phari, to our intense relief, and somewhat to our surprise, was almost balmy. There we had rather more than our expected troubles with the local authorities, who are of a peculiarly grasping nature, and had taken the opportunity of putting up the prices of everything 25 per cent. over 1922 rates. We had a two days' battle, and a dramatic *finale*, when a telegram to the Prime Minister of Tibet reporting their conduct was torn up in their presence as soon as a suitable agreement had been arrived at. We had previously discovered that orders had come from Lhasa directing every assistance to be given us, but the final collapse of the Phari authorities was both dramatic and amusing.

From Phari began the second stage of the march across Tibet to the Base. We left Phari on April 7, the main party, owing to the curious district restrictions on transport in Tibet, marching *viâ* the Dongkar-La to Kampa Dzong, and Major Hingston, Mr. Macdonald our postal expert, and myself going with a light outfit by the Tuna, Dochen, and Tatsu Tatsung route. However, I was obliged through illness to relinquish the command of the Expedition at Tuna, and hand it over to Colonel Norton.

Disappointing as this step was, it was partially made up to me by the personality of my successor, for no finer or more inspiring leader could have been found, and this is borne out by the manner in which he dealt with the immense difficulties and hardships occasioned by the terrible conditions met with this year.

One word about the weather. All through May there was a wave of cold and wet weather over the whole of the Western and Central Himalaya, brought by strong winds from the west, and giving in the Panjab and North-West Provinces almost the lowest temperatures ever experienced for that time of year. These storms and winds had nothing to do with the monsoon, which itself was favourable, in that it was about a week later in arriving in the Eastern Himalaya than is usual. This condition was a thorough bit of bad luck, and very unusual. I think it

will be seen that at the time of the final effort on Everest the weather was extremely favourable, which was probably due to the slight delay in the monsoon.

With regard to the porters, they had an extraordinarily rough time, but to get so large a percentage as six men who were able to carry loads to the terrific height of 27,000 feet is in itself remarkable, considering the way the men had to be chosen; for, after all, with the exception of certain old hands, they were picked from a crowd of men who had come for daily labour to Darjeeling.

I will leave it to other members of the Expedition to give an account of the personal prowess of its members, but I must draw attention to the results of the Expedition.

It is perfectly clear that the summit of Everest can be reached—certainly with oxygen, and in all probability without it—for there is no doubt that the very severe conditions experienced before the weather cleared up left the members of the Expedition less fit than they otherwise would have been.

We have quite clearly increased the standard of expectation. Who would have thought four years ago that men could climb without oxygen to over 28,000 feet? Who would have thought that three ascents between 25,000 feet and 27,000 feet would have been accomplished inside the same week by the same climber? And who, again, could possibly have forecast that men were to be found who could possibly carry loads to a height of 27,000 feet?

A slight addition has also been made to the geography of the mountain. The West Rongbuk Glacier and its neighbourhood have been surveyed, and other additions to the map have been made at the head of the Dzakar Chu. Another great Himalayan gorge also has been further explored, the Ringshahr.

Later on, no doubt, Major Hingston will give an account of his physiological observations on members of the Expedition, and he has brought back also an immense collection of insect and plant life.

I will now hand the story on to Colonel Norton, who will tell you about the *personnel* of the Expedition.

## III. THE PERSONNEL OF THE EXPEDITION

### Lieut.-Col. E. F. Norton, D.S.O.

I feel that an account of an expedition which omits some description of the members is a sadly colourless business. I should like to be able to make these men real flesh and blood to you instead of mere lay figures. Unfortunately the time available is too short for me to hope to do this, even had I the talent, and I must content myself with a very brief introduction.

I have an uncomfortable feeling that, as I go on, you will conceal a smile at what you may term a mutual admiration society. I would be the last to suggest that we were a party of little tin saints, but it is a matter of common knowledge that expeditions involving some hardship have a way of bringing out the best that is in every man and of obscuring his faults. In this lies the greatest virtue of such enterprises. It is not my business to-night to talk of the faults.

When *General Bruce* went sick we sustained a loss which—irreparable as the loss of such a leader must be to any expedition—was doubly so in an exceptional year. For it was just in the conditions which we met this year that General Bruce's well-known influence over our Himalayan *personnel* might have made so great a difference.

Yet it must not be forgotten that we owe him much of what was achieved this year. To him must be given the credit of having collected the very strong party we were, for with him rested the last word in the selection of the British members, and it was he who actually chose the porters and other Himalayan establishment.

The very name of Bruce is a charm to conjure with all along the Himalaya, but more particularly in and around Nepal. He it was who, by his treatment of the people of the country great and small, consolidated the permanent way across Tibet which a Mount Everest expedition now follows so comfortably.

I would add that—much as I appreciated the chance of leading this year's party—no one recognizes more than I do what we lost when we lost our leader, and it was with nothing but regret that I got my opportunity under such circumstances.

I think every one will agree with me when I say that the first task of an Everest expedition is to get to Mount Everest. So I speak next of the man who virtually took us across Tibet to the mountain, and well up its slopes to the higher glacier camps.

Without *Geoffrey Bruce's* previous experience and sound advice we should often have been sadly at a loss on our journey to the Base Camp; and, arrived there, it was organization which established Camps I., II., and III. in record time. But first and foremost it was Geoffrey Bruce who ran our porters: he it was who disciplined them, who attended to their wants and comforts, and who put heart into them when they were down on their luck. For he is gifted with the power of leadership, inherent in the first instance, and practised in eight consecutive years of war.

I think that if our porters were asked to sum him up their verdict would be: "The Captain Sahib is a hard man—but a just. Skrimshanking and malingering are useless with him, and he has an unaccountable lack of sympathy with the common failings of mankind;

perhaps he is a teetotaler. But he knows us and understands us and our language ; when we are really in trouble he is the man to go to. Further, he will never demand of us anything he is not prepared to do himself."

Bruce is emphatic that he is no mountaineer : then he is a very good imitation of one. Two years ago he established with Captain Finch the world's record by reaching a height of 27,200 feet odd. This year, when we re-cast our plans halfway through the campaign, he was selected to go with Mallory on the first attempt as being undoubtedly the fittest and strongest of us. Unfortunately, he temporarily strained his heart carrying into camp (at 25,500 feet) the loads of porters whose strength failed them short of camp. And so he could take no further part in the high climbing.

To my mind *Somervell* shares with Mallory the distinction of having been one of the mountain's two most formidable antagonists.

His physical toughness is remarkable : in 1922 he reached a height of nearly 27,000 feet, and was the only one of those who went high to be absolutely unaffected. His holidays in the Alps have always taken the form of climbing one first-class peak per fine day for weeks on end. This year his going power high up was seriously affected by a very bad cough and sore throat—the " high altitude throat " which attacked so many.

But Somervell has—as had Mallory—a moral reserve on which he draws to make good any physical disabilities, so that it hardly matters whether he is fit or not—he is always fit to go high on Everest ; and it was this reserve of determination which carried him this year to the North Col under circumstances of which you will hear again, and later to a height of 28,000 odd feet without oxygen.

Gifted with an exceptionally quick and versatile brain he is a surgeon by profession, an artist and musician in his spare time. One of the most familiar sights on the expedition was his figure perched on a rock sketching, or, surrounded by itinerant Tibetan musicians, jotting down their music on the back of an envelope. Not the least interesting thing in an interesting personality is that he has deliberately chosen to apply these many talents to the duties of surgeon in a Mission hospital in remote Travancore in preference to a sure success in Harley Street.

*Odell* shared one characteristic with Somervell : he acclimatized slowly. We did not in time this year draw what may well be the logical inference—that in this, as in other matters, slow is sure. Certain it is that these two slow acclimatizers have achieved more with less physical deterioration than any one else in our brief record of really high climbing. I feel that Odell was never given the opportunity he should have had this year, and that our chances of success were prejudiced thereby.

Odell's reputation as a mountaineer and an explorer is known to

most of you. Being also a scientist and a mechanic, he shared with Irvine the labours and responsibilities of the oxygen apparatus besides organizing the important department of high-altitude cooking with Primus or Meta stoves.

As a geologist not the least of his achievements was the discovery of the long-hoped-for fossils at a height of over 25,000 feet.

It was the famous firm of Odell & Irvine which gave so fine a display of the most unselfish team work in a year when team work was a salient feature. I refer to the way in which they created the *rôle* of supporter on the North Col.

Having experienced to the full the meaning of such support, I speak with feeling. On its way up the mountain each party was welcomed by the Old Firm, its tents were allotted, it was fed, waited on, and served in every way. I leave you to guess how these attentions were redoubled when the same climbers returned somewhat the worse for wear after going high, and the supporters met them with lights and drinks well on the Everest side of the North Col and took complete charge of the weary party.

Odell alone has carried out the last and hardest task of a supporter—the forlorn-hope search for a party fatally overdue.

If the performance of these duties denied him his chance of the top it gave him another opportunity: it gave him the opportunity of beating all records for continuous climbing at really high altitudes. For in addition to three previous trips from No. III. Camp to the North Col—one successful and two abortive—he in ten days did this same climb three times, and went from Camp IV. once to 25,500 and twice to 27,000 feet. The astonishing thing about this performance is that he finished up very little the worse for his exertions.

The stars in their courses fought against ***Beetham***, and so deprived us of the services high up of a mountaineer of exceptional speed and endurance.

Passing through Sikkim on the outward march he contracted a severe go of dysentery. By sheer determination and force of character he recovered by the time we reached the Base Camp from an illness that would have sent many of us back to the Swedish Mission in Sikkim. Just as he was getting fit again at the Base Camp he was attacked by sciatica and badly crippled.

Heartbroken at being out of all that was going on, he got out of bed and, defying doctor's orders, he struggled "dot and carry one" up to No. III. Camp—determined to cook, to carry, to do anything to help the rest of the party. But here it was so evident—despite his sedulous efforts to conceal the fact—that he was a cripple that his brutal leader had to return him to the Base.

He contributed the majority of the still photographs this year, and

the public will have the chance of judging the very great success of his efforts in this direction.

But his whole heart was above the North Col.

I can only say that if an indomitable spirit coupled with every physical qualification of a first-class climber is what we want on Everest, you should hear of Bentley Beetham again. No mountain in the world can stand against the concentrated rage that he will bring to bear on his next attempt.

*Hazard*, like Odell, acclimatized slowly, and that his part in the high climbs was not a greater one may be largely attributed to this. He went to 25,500 feet, and, on Irvine's departure on the last climb, took his place as supporter on the North Col, to which he had already twice escorted convoys of porters.

When, heartily sick of the squalor and discomfort of high-altitude tents and feeding, we left the Base Camp for our little holiday among the trees and flowers of the Rongshahr valley, Hazard volunteered to lead a survey party back to the ice and snow of the West Rongbuk glacier, of which the reconnaissance was regarded as a task of some importance. Undeterred by the breaking of the monsoon the day after he started, he successfully carried out this operation, and we owe the results achieved to his hardihood, for—with the exception of Beetham, whose photographic skill was needed in the Rongshahr—no one else would have volunteered for a prolonging of conditions of which we had had more than enough.

*Hingston* was our doctor and naturalist.

The qualities required for a doctor on an expedition of this sort are peculiar. Medical skill is one of them, and Hingston was well qualified in this respect.

Far more important are the human qualities of common sense, sympathy, and energy; the power to detect unerringly the really sick from the fancied sick, the power to enlist the confidence of the simple hill-folk with whom we had to deal. It was the possession of these qualities that made our doctor the right man in the right place.

As a naturalist he probably enjoyed the whole expedition even more than any of us; and when I tell you that his collections include some ten thousand specimens it will give you some idea of his industry and keenness. Every stone in Tibet was to him a potential gold-mine, for under it might lurk something really fascinating—such as a tick.

Hingston professed himself no mountaineer, and I believe he was right in that he has only a limited experience of ordinary snow slopes in the Pamirs, and has done no climbing in the Alpine sense. But it was characteristic of his all-round efficiency that he once escorted a blind man down the 2000 feet of formidable ice cliffs, snow slopes, and glacier

between the North Col and No. III. Camp, placing his every footstep and holding him up in complete security in a style that would have done credit to an Alpine guide.

*Shebbeare* is in the Indian Forest Department: his work has taken him much into the foothills of the Himalayas in Bengal; consequently he talks Nepalese and knows and understands the hill-men. These qualifications helped to make him the valuable transport officer he was.

But it was his temperament that made him so great an asset to the party. Not for nothing has he the reputation of being the most popular man in the Darjeeling district, for he is peculiarly gifted with those qualities of good nature, equanimity, and sympathy which made him as popular with our porters as with the British members of the party.

Hence it was that once he was established as king of Camp II. i/c of lines of communication, we never had to give a thought to this department, no less important on an expedition of this nature than in war, while the porters were content in the knowledge that they had a " father and a mother " in the old " she bear."

The name of *Noel* is as familiar to most of you as his work.

This year he specialized on the cinema, leaving most of the still photography to Beetham. The results of his most assiduous labours and of his organizing ability will speak for themselves. It is more of his part as a member of the expedition that I would speak now. For though he ran his own separate organization he was out to help the main expedition in every way, and his arrangements were so detailed and perfect that he was often able to supply us with equipment or man power when these were most welcome. Even now I cannot think of his little tins of potted meat without emotion.

From the loan of a magnesium flare as a distress signal to an offer to act as supporter up to any height there was nothing he was not ready to do for the furtherance of our schemes. As he is entirely unaffected by cold and hardship, and has a happy gift of hitting it off with the hill-men, he was a most valuable member of the party, apart from his technical skill in his own department.

In two years *Mallory* and I have spent many weeks together in a small tent; we were friends, and if you share a tent with a friend you get to know him very intimately.

Mallory had an ideal figure for a mountaineer, but it would have made little difference had he been of an inferior build—so entirely did his spirit dominate the flesh: of him might have been written the lines

> " If you can force your heart and nerve and sinew
> To serve your turn long after they are gone,
> And so hold on when there is nothing in you
> Except the Will that says to them, ' Hold on.' "

A fire burnt in him, and it made him one of the two most formidable antagonists Everest has ever had. He was absolutely determined to conquer the mountain, and no one knows better than I do how for several months this year he devoted his whole mind and will to this object.

At the same time those who suggest that he may have taken chances to achieve success in his last climb misrepresent him. For equally strong as his will to conquer was his sense of responsibility as leader of a party, and I know that he was prepared—nay, determined—to turn back however near the summit if it could not be reached in time to return in safety.

To his organizing power, his remarkable gift of concentration, his genius for detail, and his true appreciation of the task before us we owed this year much of our plans and much of our organization on the mountain.

In the Mess he afforded a marked contrast to what he was when actively employed : his temperament was singularly æsthetic and cultured for such a man of action. Impatient by nature, time had taught him a great patience, and this was one of the things that made it so pleasant to work and plan with him.

Such was Mallory. His death leaves us the poorer by a loyal friend, a great mountaineer, and a gallant gentleman.

*Irvine* was once referred to by General Bruce as " our experiment," for he was young—twelve years younger than the average age of the party—his mountaineering experience was limited, and he departed from what we considered the true Everest type in being big and strong rather than light and limber.

It did not take him long to justify the experiment. If he was young he was a man full grown mentally and physically, and at once took his place with all modesty on equal terms with the rest ; if he was an inexperienced climber he proved one of the fastest of us, and I believe, though I never actually climbed with him, as sure and safe as any. If he was on the heavy side he was strong and active to a degree.

Mechanically he was a genius : from a broken camp chair to the more complicated valves of the oxygen apparatus, nothing came amiss to him. His tent daily assumed the aspect of a fitter's shop ; here until late at night he would be found hard at work on the oxygen apparatus or doing some job for a friend who had long been tucked into his warm blankets.

He was always the willing horse.

Selected to take part in the first attempt with oxygen, he was, in our revised plans, relegated to a later attempt, giving place to others who were to try first without oxygen ; as a result he, with Odell, became a supporter on the North Col. He never even hinted at disappointment, but tackled with unselfish energy and his usual enthusiasm the part of cook or scullion or nurse to a cripple.

That Irvine was loved by all of us for his cheery unselfishness, his

camaraderie, and his manly qualities goes without saying. It is perhaps more significant that he was loved by the porters, not a word of whose language could he speak.

Together these two went up the mountain for the last time: higher than ever man has been before they were last seen—one giving a hand to the other, and then—they were seen no more.

Could either have wished for a better friend to hold his hand at the crossing into the unknown land beyond?

## IV. THE JOURNEY THROUGH TIBET AND THE ESTABLISHMENT OF THE HIGH CAMPS

### Captain Geoffrey Bruce, 6th Gurkhas

The route taken this year across Tibet was almost identical with that of 1922. The uplands between Phari and Khampa Dzong, particularly the Dongkar-La, were as usual bleak and cold, but with the experience of 1922 behind us we were able to travel in far greater comfort than before. The baggage train consisted again of over 350 animals—yaks, donkeys, and bullocks—changed at each Dzong (capital of a district) aloug our route. This year we had very little difficulty over transport arrangements. Several of the Dzongpens we already knew. One and all seemed pleased to see us, and to do what they could to help us on our way.

From Khampa Dzong onwards there were no hardships or difficulties to speak of. Evenings, on arrival in camp, were generally spent in oxygen drills, conferences about plans of climbing the mountain, and so on. Beetham was very unlucky in suffering from an attack of dysentery in the early part of the march, but he refused to give in, and by the time we reached the base camp he had almost got over it.

On April 23 the Expedition arrived at Shekar Dzong. Our old friend, the Dzongpen, rode out to meet us, and it was at once obvious that he was ready to give us every assistance. Everest itself lies in his district, and it was a very great comfort to know that we had this capable and straightforward man to deal with. Our two days' stay there was busily spent in arranging with the Dzongpen for grain, meat, and fuel to be regularly supplied to the Base Camp during the next two months. He also gave us much personal help in collecting coolies to be used on the glacier in addition to our own specially enlisted porters. These coolies will be mentioned again. Four days later (April 28) we camped at the Rongbuk Monastery, only 5 miles from the site of our Base Camp. Unfortunately, the Lama was ill and unable to see us, or bless the porters as he did on our way through in 1922. We sent the interpreter to him with messages and presents—among the latter a yak-load of cement which he had specially asked for in 1922 for repair work to his monastery.

The following day we came to the end of the four and a half weeks' trek from Darjeeling, having experienced no really unpleasant weather the whole time. But conditions at the Base Camp were quite different. We arrived with snow falling and a bitterly cold wind. We were soon into all the warm clothing we possessed, and then buckled to the task of establishing the camp and sorting out stores and equipment ready to push up the glacier on the morrow. It had been decided to reoccupy the old sites of Nos. I., II., and III. Camps, and to have them established for the first attempt on the summit to take place on May 17. The position and heights of the camps were roughly :

Base Camp, 16,500 feet.

No. I. Camp at the junction of the Main Rongbuk and East Rongbuk Glaciers, 17,800 feet.

No. II. Camp, halfway up the East Rongbuk Glacier, 19,800 feet.

No. III. Camp, on the snowfield at the head of the East Rongbuk Glacier close under the North Peak, 21,000 feet.

Following this, Odell and Hazard were to reconnoitre and construct the route up the North Col. Odell and I were to establish Camp V. and return ; then two simultaneous attempts should start for the summit, made by Norton and Somervell (without oxygen) and by Mallory and Irvine (using oxygen). To this end the tentage, rations, and equipment intended for each camp were selected and put into separate dumps on arrival at the Base, and the four Gurkha N.C.O.'s were entrusted with the important task of establishing Camps I. and II., and, in addition, putting into Camp II. all the loads required for Camps III. and IV., and the high camps on the mountain itself. In order to meet this big demand on porterage and to save our own men we had, through the good offices of the Shekar Dzongpen, started to collect local coolies at Shekar, and continued recruiting them between there and the Rongbuk Monastery. We now had at the Base Camp over 150 of them ready to begin work at once. Their terms were : pay at the rate of four tankas (about one shilling) a day and some rations. They were not to be employed on snow or ice, and requested to be quickly released when the work was done as they had the sowing of their fields to attend to. They undertook to look after themselves as regards tentage and extra blankets, but, as a matter of fact, they scorned the use of either.

On April 30, under better weather conditions, a convoy of 151 Tibetans under three Gurkha N.C.O.'s left the Base Camp for Camp I. Half the Tibetans were to remain in Camp I. and carry up to Camp II. on the next day, while the remainder were to leave their loads in Camp I. and return to the Base Camp for the night. On the following morning we were greeted with the news that of the 75 local coolies at the Base Camp 52 had deserted in the night. This was a very serious matter, and we feared that the Gurkha N.C.O.'s at Camp I. might be experiencing similar trouble. A transport strike at this juncture would effectively

cripple our detailed programme, so Norton, Shebbeare, and I went up at once to Camp I. to see how they were faring. We were greatly relieved to find that there was no sign of discontent among the Tibetans, and that the N.C.O.'s had everything well in hand and running smoothly. While we were there the first convoy from Camp I. to Camp II. was just returning. It consisted of men and women. We sat them down in lines and gave them extra rations and a promise of a rise in pay if they completed the establishment of Camp II. by the following evening. They were delighted and showed no inclination to be off home. One of these coolies—quite an elderly woman with grey hair—actually danced a *pas seul*, although she had just carried a 40-lbs. load to Camp II. over rough and difficult ground. Another woman—a mother—had insisted on carrying her lusty baby all the way on the top of her already full load, and now came into camp fresh and smiling. What was more, she and all the others were prepared to sleep again in Camp I., with no tent accommodation or extra blankets, and repeat the performance next day.

No more desertions occurred, and by the evening of May 2 we received a message from the Gurkha N.C.O.'s at Camp II. saying that Camps I. and II. were fully stocked as ordered. In these three days over 180 loads were put into Camp II. That evening all the local coolies were given a large feed and paid off, after which they went off towards Rongbuk in high spirits.

In the mean time our own Porters Corps was organized for work higher up into two parties of twenty each and a reserve of twelve. Briefly, they were to be utilized as follows: No. 1 Party were to go through with some of the climbers to Camp III., establish it, and remain based there for getting the next camp on to the North Col. A day later No. 2 Party were to move into Camp II. for the purpose of working between II and III. The reserve were to remain for the time being at the Base Camp. The Gurkha N.C.O.'s were to be in charge of the three camps to see to the feeding and welfare of every one in them, and to supervise the arrivals and departures of convoys.

The weather had now improved a little, but it was mainly cold and stormy, and the conditions on the mountain looked forbidding. Nevertheless we were able to go forward with the plan. On May 3 Mallory, Odell, Hâzard, and Irvine left the Base Camp with No. 1 Party. No. 2 Party started on the 4th under one of the N.C.O.'s; and Norton, Somervell, and Beetham on the 6th. I followed with the reserve party on the 7th, while Shebbeare remained in charge at the base

Our good luck was not destined to last long. To begin with, poor Beetham, having recovered from his dysentery, now succumbed to a crippling attack of sciatica, which finally prevented him getting on to the mountain at all. I reached Camp II. on May 8. There things were far from happy. Most of the No. 1 Party of porters had been

unable to remain in Camp III., chiefly owing to the failure of No. 2 Party to carry their loads the whole distance from Camp II. to Camp III. Instead they had made a dump on the glacier below Camp III., and the men in Camp III. did not receive their extra blankets or rations, and suffered terribly.

Mallory came down from Camp III. to see Norton, and explained that there had been a temperature of −22° F. the first night there, and very low temperature the next night. The men were all complaining of hardships and looked crestfallen and weary. The situation was a difficult one, and it was fully realized that the *morale* of the porters must at all costs be raised. The first step was to send for Shebbeare to come up to Camp II. and take charge. It was essential that there should be an officer at this camp who could speak the language, and ensure the safe arrival of convoys into Camp III.

It is worthy of note that from the moment Shebbeare came up and established himself as king of No. II. nothing ever again went wrong on the lines of communication.

In the mean time Somervell with a few men of the No. 2 Party got off to relieve the food situation at Camp III. The rest of the day was spent by Norton and Mallory in revising the plan, while I endeavoured to put some heart into the men. On the whole the results were good, for on the following morning Norton, Mallory, and I with a convoy of twenty-six porters left for Camp III.

The route over the glacier was somewhat changed from 1922, for instead of crossing the trough we followed along it for quite a distance. Here the scenery was wonderful, but one was in no mood to enjoy it. This part of the glacier is within the " gates of altitude," and in addition produces a special brand of lassitude which saps one's energy and enthusiasm for anything. Fantastic blue pinnacles surrounded us like a forest—some of them gigantic when we entered the trough, getting smaller as we emerged on to the glacier itself. The glacier surface consisted of absolutely smooth ice, varied by depressions and cracks full of powdery snow. Snow began to fall shortly after we left Camp II. It continued to fall all day, getting heavier and heavier and finally assuming proportions of a real blizzard, which was to last for forty-eight hours. The porters at Camp III. were wretched; the cold was getting at them badly. Many became so apathetic that they would not even attempt to cook food for themselves, although I pushed Primus stoves and oil inside their tents for them.

Wind and snow continued that night with unabating violence; the snow drifted into our tents to a depth of an inch or two, making everything miserably uncomfortable. Morning came and the snow stopped falling, but fallen snow was being hurled along the surface of the glacier by the wind, producing the same effect as a blizzard. Kami, our cook, rose manfully to the occasion, and produced for breakfast at about 10 a.m.

an unrecognizable mess in a Primus stove, followed an hour later by extremely unpalatable tea, which had been brewed in the same greasy pot. Still, it was hot and comforting, and we shall always be grateful to the faithful Kami.

We then reviewed the situation, and it was decided that Mallory and Irvine should move down to II. as a temporary measure and prepare for the possibility of evacuating altogether should the same weather continue. A message was also sent to stop Noel coming up with his cinema outfit, with which he subsequently obtained remarkable results. During the day Norton and Somervell did an excellent piece of work in braving the blizzard and getting down to the dump with seventeen porters and bringing up nineteen loads. As evening came on the wind blew still harder in tremendous gusts from every direction; the tents were again filled with snow, and the temperature fell to 39° below freezing-point.

Now there was no other course left but the evacuation of the whole line. The porters were in a bad way, the climbers were by no means improving, and in any case the North Col route would have been impracticable for several days. But to evacuate Camp III. was no easy matter, for the porters were all huddled up in their tents, having lost the will to move or even cook for themselves. After compelling them to cook and eat, we turned them out and struck camp, leaving tents, stores, and fuel piled in some kind of order.

Then we took to what Norton has described as the "Via Dolorosa," first the wind-swept glacier down to Camp II., then the rough miles of the tumbled moraine; withdrawing every man to the Base Camp with a melancholy procession of snow-blind, sick, and frostbitten men being shepherded down by their comrades. But we knew that everything was ready for us to return up the glacier, and only a small amount of high-altitude stores remained to complete Camp III. for the first attempt.

How had we all stood Round 1? The British members were in good health, and full of optimism. They had all acclimatized themselves up to 21,000 feet. Further, a strong reinforcement had arrived in the shape of Hingston. He had left General Bruce in Gangtok and hastened across Tibet to rejoin us. He was in the nick of time to relieve Somervell of the heavy duties of medical officer. In the Himalayan ranks we were not so fortunate. One man was severely frostbitten in both feet and subsequently died. One man had broken his leg; several had bad attacks of bronchitis, and, worst of all, the Gurkha N.C.O. Shamsher was in a very serious condition with hæmorrhage on the brain. After twenty-four hours' unconsciousness he died while being carried on a stretcher into the Base Camp. He was a very great loss to the Expedition, and to his regiment, where he undoubtedly had before him a brilliant career.

The weather had by now improved, and after even one day's rest at the Base Camp the men were beginning to look their normal cheery selves

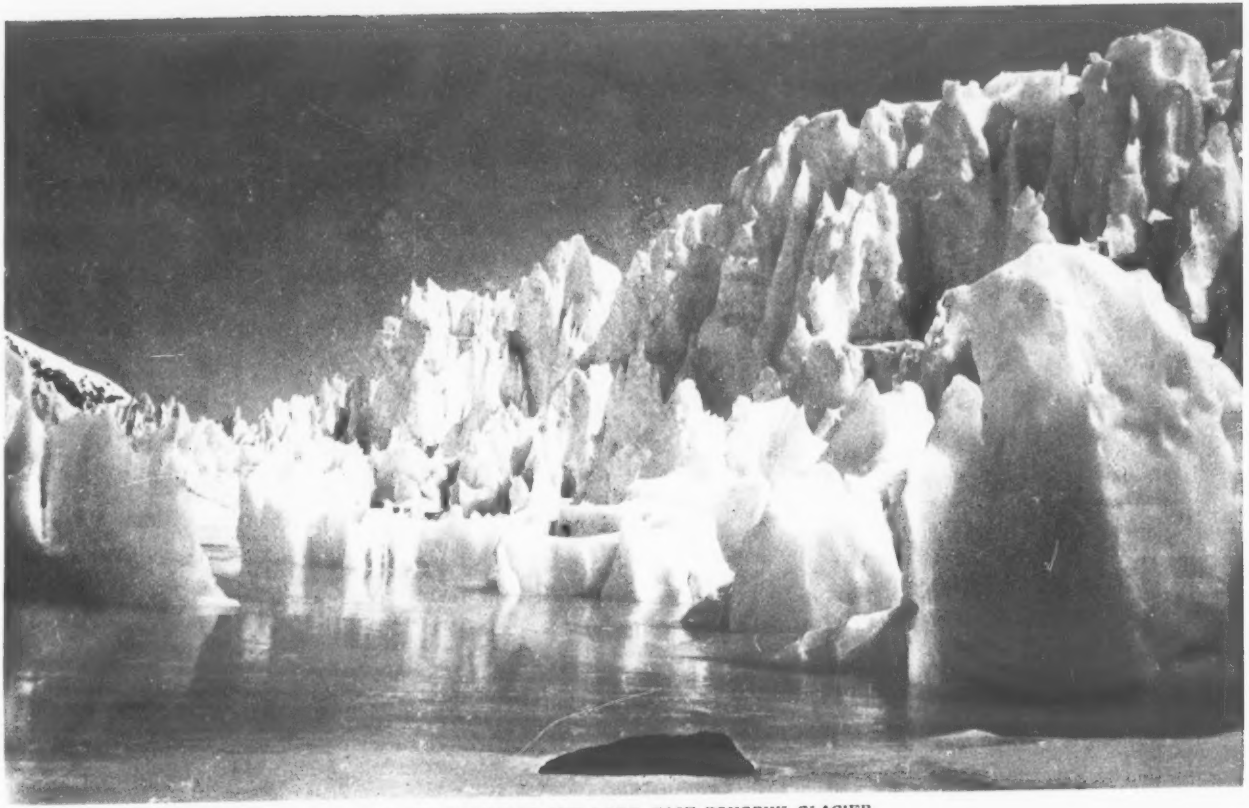
again. They were all very keen to pay a visit to the Rongbuk Monastery, 5 miles down the glacier, and receive the blessing of the Holy Lama, who had now recovered. This was duly arranged to take place on May 15, and was an unqualified success. The Lama conducted an impressive service, and sent them away happy and full of courage for further efforts. That evening in the Base Camp the interpreter Karma Paul—a rather vain youth and apt to be a little carried away by his own self-importance—announced that the porters were very pleased that the interpreter and the Colonel Sahib (note the order) had arranged such a good show for them. A feature of the Base Camp about this time was a herd of Burhel (wild sheep) which came grazing the scanty tufts of grass right down to our tents.

The Lama's blessings had apparently worked wonders with the weather and the men, so after sundry pieces of reorganization the advance was resumed, and by May 19 Camp III. was re-occupied. Round 2 had now begun, and was remarkable for the spirit of team work displayed by everybody, and the excellent comradeship which existed through all ranks of the Expedition.

On May 20 Norton, Mallory, Somervell, and Odell left Camp III. to reconnoitre the route up to the North Col—that dangerous wall of ice, like a trap set at the foot of the mountain. Just below the slopes it became evident that Somervell was far from fit, and he had reluctantly to return to camp. He told me afterwards that he had taken his temperature the night before and found it to be 104°. It was little short of marvellous how he managed to start at all in the morning. Mallory, too, was suffering from a bad cough, and only his great heart carried him on. However, they succeeded in working out a new route right up to the No. IV. Camp site, designed to be safe from avalanches, and satisfactory except for an ice chimney 150 feet high. The old route looked very unsafe and certain to avalanche. They did a fine day's work, and returned to Camp III. that evening.

On May 21, morning broke warm with a lot of cloud about. Light dry snow kept falling at intervals. This day the North Col Camp was to be established. Somervell, Hazard, and Irvine got off at 8.30 a.m., with twelve porters, their plan being that Somervell and Irvine should return to Camp III. while Hazard remained in IV. till the next day, when Odell and I would arrive there, stay the night, and then proceed to establish Camp V. At 1 p.m. it began to snow in earnest—very soft, wet snow—and nothing could be seen of the North Col from Camp III. At 6.30 p.m. Somervell and Irvine returned, having left Hazard and his twelve men within easy reach of Camp IV. They told us that they had found the ice chimney too narrow for the majority of loads. Somervell and Irvine had established themselves at the top while Hazard directed operations from below, and all twelve loads were hauled up by rope. It was a tremendous effort, and over two hours were thus spent.

1. THE NORTHERN CLIFFS OF MOUNT EVEREST FROM THE RONGBUK GLACIER

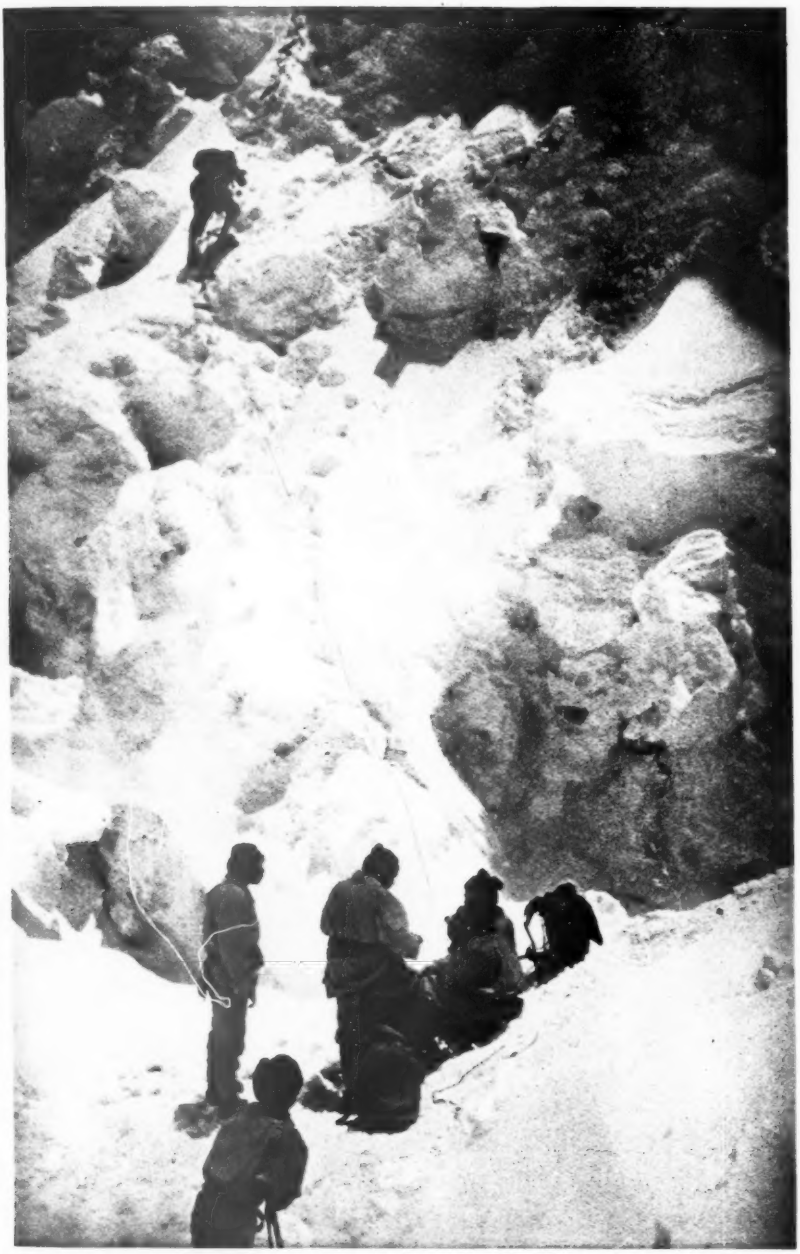


2. ICE PINNACLES AND LAKE, EAST RONGBUK GLACIER

2. ICE PINNACLES AND LAKE, EAST RONGBUK GLACIER

3. THE TROUGH, EAST RONGBUK GLACIER, LOOKING DOWN TOWARDS CAMP II.

4. THE FLOOR OF THE TROUGH, EAST RONGBUK GLACIER



5. THE ROPE LADDER BELOW THE CHIMNEY, SLOPES OF THE CHANG LA

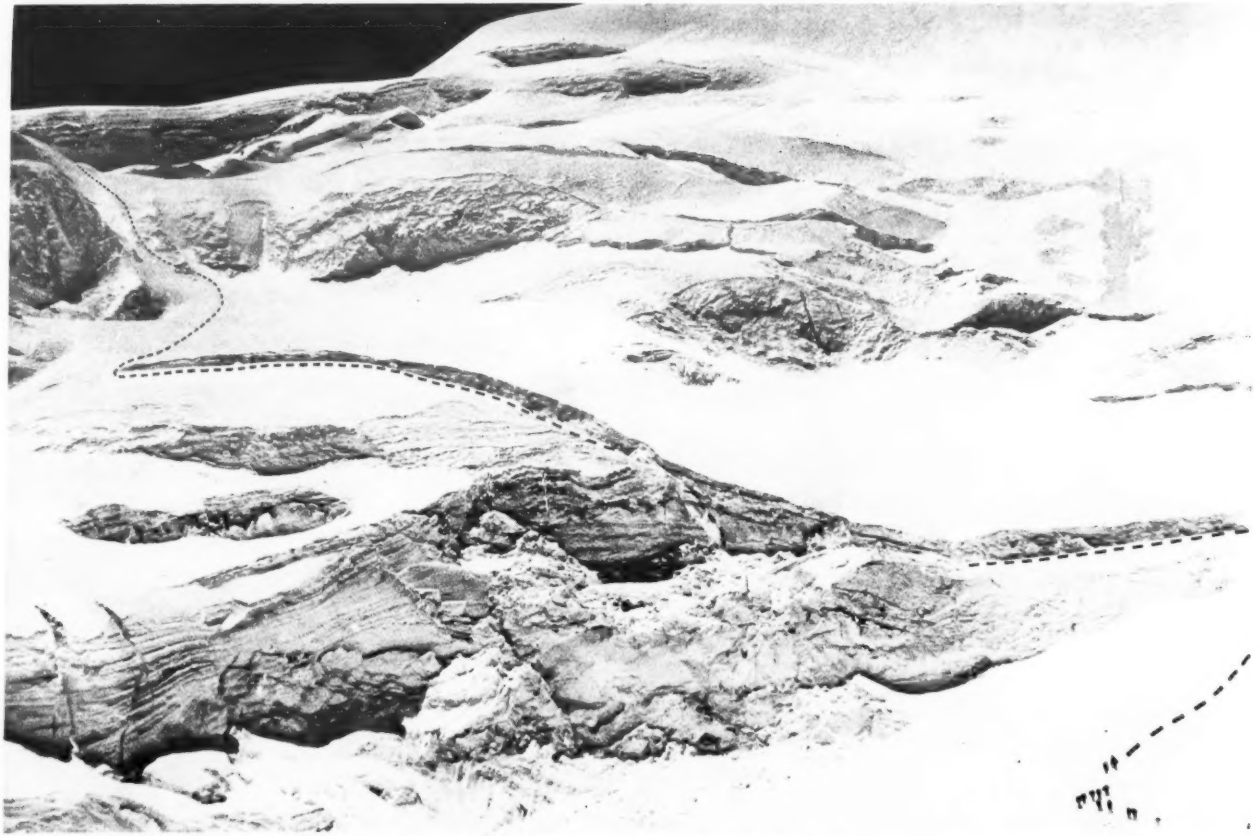
6. THE CHANG LA AND HEAD OF EAST RONGBUK GLACIER FROM NEAR CAMP III.

6. THE CHANG LA AND HEAD OF EAST RONGBUK GLACIER FROM NEAR CAMP III

7. THE ROUTE TO THE CHANG LA

THE UPPER GORGES OF THE CHANG LA

8. THE UPPER SLOPES OF THE CHANG LA



9. ROUTE ON THE UPPER SLOPES OF THE CHANG LA

10. THE CHIMNEY

11. ROUTE UP THE CHIMNEY

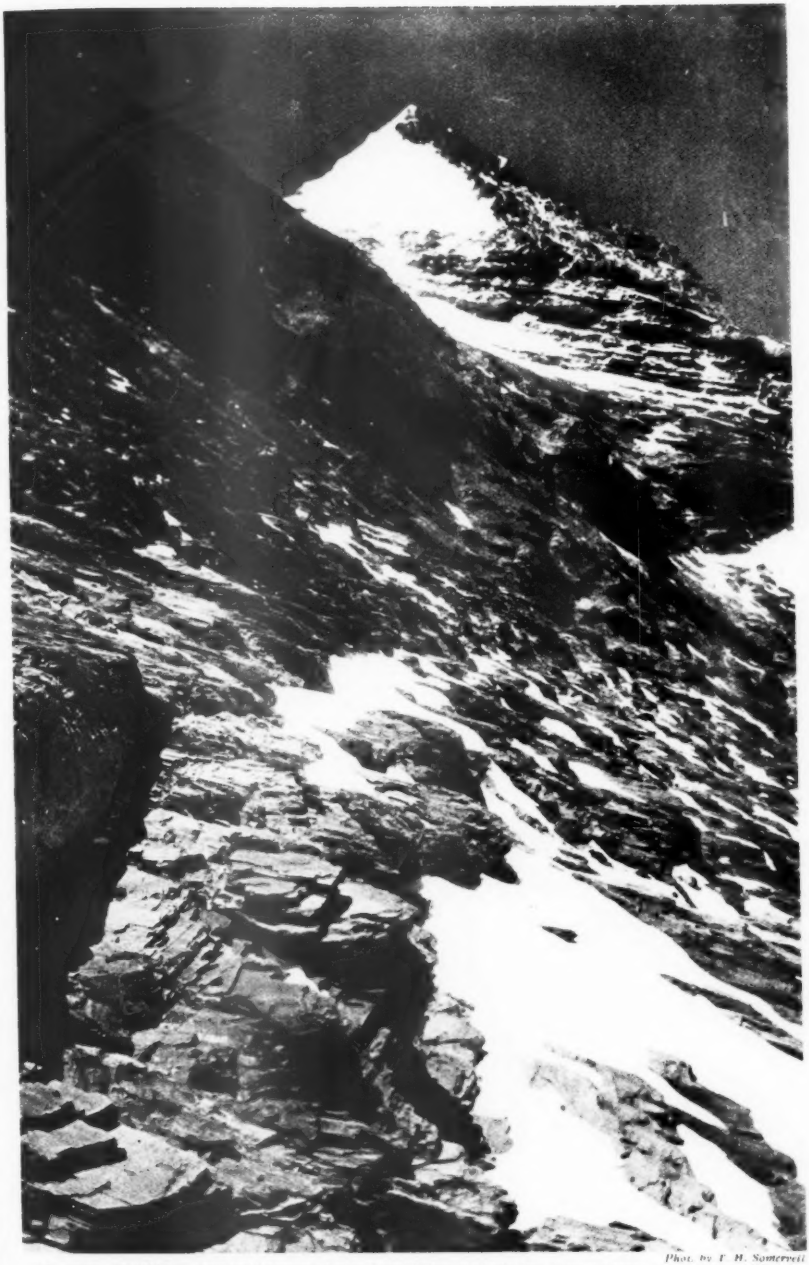
Cho Uyo Gyachung Kang C..an,..se

Phot. by T. H. Somervell

12. GYACHUNG KANG AND CHO UYO, FROM ABOUT 25,000 FEET

Phot. by T. H. Somervell

12. GYACHUNG KANG AND CHO UYO, FROM ABOUT 25,000 FEET



Phot. by T. H. Somervell

13. COL. NORTON APPROACHING THE HIGHEST POINT OF HIS CLIMB AT 28,200 FEET

*Phot. by T. H. Somervell*

14. LOOKING NORTHWARD FROM 28,100 FEET ON MOUNT EVEREST

Gaurisankar

Pumori

Cho Uyo

Gyachung Kang

Phot. by T. H. Somervell

14. LOOKING NORTHWARD FROM 28,100 FEET ON MOUNT EVEREST

Gaurisankar Pumori Cho Uyo Gyachung Kang

Phot. by T. H. Somervell

15. LOOKING WESTWARD FROM 28,100 FEET ON MOUNT EVEREST

16. THE MONUMENT TO THOSE WHO DIED ON THE THREE EXPEDITIONS. BASE CAMP, RONGBUK VALLEY

But Fortune had again ceased to smile on us. Snow fell all night and all the following day until 3 p.m. It was quite impossible to do anything but lie in our sleeping-sacks and hope for the best. That night (May 22) the temperature fell to 56° of frost—the coldest ever recorded in an Everest Expedition. The morning of May 23 was, however, an improvement—a cloudless, brilliant day. The wind had dropped, but the air was keen and cold. Odell and I got off at 9.30 with seventeen porters bound for Camp IV. The mountain towered above us, sharp and clear in every detail. The party was going well and all were in good spirits. At one of the frequent short halts on the glacier the men were discussing the mountain and saying how easy it looked to climb. They asked me whether they would be allowed to go to the top or whether it would be climbed by Sahibs only. Again we were frustrated, for shortly after mid-day snow started to fall. Instead of a brief hour's walk to the foot of the Col three hours were required. The slopes of the Col were in a dangerous condition, and we deemed it unsafe to take laden porters on. Accordingly we made a dump at the furthest point reached and retreated to Camp III.

At about 5 p.m Hazard arrived, but with only eight of his party. While he had gone ahead piloting his men along the steep traverse at the top of the Col, four of them had lost their nerve and remained there marooned. This was a terrible situation, especially as it transpired that a load of mixed porters' rations for Camp IV. had been accidentally dropped over an ice cliff and the marooned party had nothing but barley meal to eat. Further, conditions all seemed to point to a real monsoon current. Norton therefore decided that while the rest of us were to evacuate Camp III. and get the men back to lower camps, he, Mallory, and Somervell were to tackle the arduous and dangerous work of rescuing the four marooned men. Were men ever faced with such a task? They were themselves far below par, from previous exertions and hardship, Mallory's cough and Somervell's throat being really bad. Their chances of being avalanched were considerable. What if they failed to bring off the rescue? What would they do if they found some of the marooned frostbitten and unable to move? The Sherpa porter is very superstitious. These men might by now have gone off their heads with fright and hurled themselves down the ice slopes. The porters told me some days later that during their night on the North Col they had distinctly heard the fierce barking of the watch dogs, guarding the Goddess' abode.

The rescue party can have slept little, thinking over what lay before them, and listening to the soft snow falling and lessening their chances of success. They started from Camp III. about 7.30 next morning, going so badly that their hopes of accomplishing the rescue were very low. Up the Col they led in turns, and so came to the last traverse. This was covered with fresh snow, which looked as if it might avalanche

16. THE MONUMENT TO THOSE WHO DIED ON THE THREE EXPEDITIONS. BASE CAMP, RONGBUK VALLEY

at any moment. Somervell was now leading. Norton and Mallory belayed the rope and prepared to hold if Somervell slipped. The four marooned porters were waiting on the other side. It was doubtful whether the rope was long enough. Somervell cut steps all the way across, constantly stopping to lean his head on his arm and cough. He reached the end of the rope, and found he was 5 to 10 yards short of the goal. The men must cross to him—with no rope! The first came over safely and proceeded towards Norton and Mallory. Just as the second was joining Somervell the last two men slipped and began to slide towards certain death, but they miraculously pulled up in a few yards. Somervell was now superb, and perfectly cool. He told the two men to remain still whilst he passed the second man back along the rope, joking the while, so that one of the two men sitting shivering on the edge of the ice cliff actually gave a short bark of laughter. They sat like statues. Somervell then drove his axe in up to the head, pulled the rope tight, passed it round his axe, and so made enough rope to reach the men with one arm at full stretch, holding the very end of the rope with the other. He dragged them up in turn by the scruff of the neck and passed them along to safety. It was a first-rate performance.

It was now 4.30 p.m. One man was badly frostbitten in the hands (he subsequently recovered) and two others slightly in feet and fingers. The men behaved splendidly on the way down, but the rescuers had their work cut out to bring them in. In the chimney, Norton held the full weight of the badly frostbitten man no less than four times, and Mallory and Somervell were, as usual, towers of strength. They reached Camp III. at 8 p.m. It was a gruelling day, but a triumphant success.

Meanwhile the second evacuation had taken place, the climbers being distributed at Camps I. and II. So ended Round 2.

We came to the conclusion that after all they had gone through only fifteen of our porters would be fit for further efforts at any great heights. These were collected in Camp I. and formed into a *corps d'élite*, called "the Tigers." On the efforts of this little band our success now very largely depended. It may possibly be thought from this that the Porter Corps as a whole was a failure. Let there be no misunderstanding on this point. True, the majority had shot their bolt, but they had performed some stupendous feats of carrying, often on several successive days, and under terrible conditions. And as for the "Tigers," we never really got to the bottom of what they could do right up to the end.

On May 27 a council of war was held in Camp I., and from this point the story will be continued by Colonel Norton, our leader and the inspirer of all our efforts.

## V. THE CLIMB WITH MR. SOMERVELL TO 28,000 FEET

**Lieut.-Col. E. F. Norton**

On our arrival at Camp I. after our second retreat, it was evident that we must re-cast our plans. For neither the very reduced number of dependable porters nor the time available before the threatened arrival of the monsoon justified any hopes of carrying out our full original programme.

Very briefly, the original plan was an attack on the summit by two parties of two on the same day—one with oxygen from a camp about 26,500 feet, one without from a camp about 27,300 feet, the parties to act independently but to afford mutual support if necessary. In the event of failure the programme was to be repeated with necessary modifications by the remaining available climbers.

Our revised plan was settled after two days' discussion at No. I. Camp. In this nearly all the party took part. It was decided unanimously to scrap oxygen and to attack the mountain by a series of attempts starting from the North Col on successive fine days, each attempt to consist of two climbers with the irreducible minimum of equipment and porters.

Our decision to abandon the oxygen and to climb in parties of two were dictated by the following considerations:

As regards the oxygen: Firstly, neither the number of porters on whom we could now count even to reach the North Col, nor the time before the monsoon, which we expected any day, were sufficient to enable the necessary number of oxygen cylinders to be got up, for so far we had only got a few cylinders to a dump halfway up the slopes to the North Col.

Secondly, the verdict of Odell and Bruce—the only ones so far to test the oxygen apparatus—was very pessimistic as regards its effects.

As regards the parties of two: First, there being only seven available climbers, the use of parties of three would have cut down the possible number of attempts to two, and it would have been almost impossible to arrange for these to be adequately supported.

Secondly, each attempt would have required an extra tent besides other equipment and stores.

Thirdly, two men climb more quickly than three.

In this connection it must be remembered that the whole of Mount Everest above the North Col is an easy rock peak.

The sequence of parties decided on was: 1st, Mallory and Bruce; 2nd, Somervell and myself. Odell and Irvine were to be in support at Camp IV. and Hazard at Camp III. The last three were to constitute a reserve for a third attempt.

On June 1 Mallory and Bruce started on their attempt from the North Col, where Odell and Irvine were already established. Somervell

and I slept that night at No. IV. Camp. On June 2, the weather being still fine, we two started at 6.30 a.m. with six porters, who carried loads of 20 lbs. or slightly less, for No. V. Camp, which Mallory and Bruce had presumably established the day before.

No. IV. Camp lay some 200 yards north of the actual Col, to reach which it was necessary to cross a confused jumble of ice and snow cut up by crevasses. Hence you emerge on to the Col and traverse it just below its crest on the further (or western) side. At this point we suddenly found ourselves in shadow and exposed to the full force of the west wind, which blighted us as the first frost of winter blights the dahlias.

The whole of this day's climb and the next was so uneventful that there is little to say about it. We followed the blunt angle which roughly divides the north face of the mountain into two parts. This is known as the North Ridge, and connects the North Col with the North-East Shoulder.

The route was familiar to us from our experience of two years before. The going is all slabby limestone rock at a fairly steep angle, varied by frozen scree with occasional patches of snow, and is entirely without difficulty or danger. When descending it is possible, by deviating a few yards, to glissade down on good hard snow for the last 2000 feet above the North Col.

After climbing for some time we were much disconcerted to see Mallory, Bruce, and their porters descending to meet us. Their explanation was simple but conclusive. Apparently the wind on the previous day had completely taken the heart out of their porters, and this morning not even Bruce's influence and command of the language could induce them to go any higher.

This breakdown of the first party enabled us to reduce our porters to four, one of whom climbed unladen, as a reserve man.

No. V. Camp, where we spent the first night, was pitched a little on the eastern side of the ridge, and so was somewhat sheltered from the west wind. Here, on the morning of June 3, I had some difficulty in inducing three of our four porters to continue the ascent. Their condition had not been improved by the fact that two of them had been injured by a fall of stones, probably dislodged from the crumbling platform built up for our tent ; one of these men had a nasty gash across the knee-cap.

I owe it to the three men who came up to the scratch that you should hear their names. They were Narboo Yishay, Llakpa Chedi, and Semchumbi, the last having the cut knee. All honour to a gallant man. He was lame for two months after.

No. VI. Camp was pitched in a cleft in the rock on the actual ridge, and we estimated its height at some 26,800 feet. Its position was dictated principally by Semchumbi's knee and the necessity for getting the porters down to No. IV. Camp in good time.

I have little doubt that, on a future occasion, some improvement could be made on the heights of both Nos. V. and VI. Camps; this is one of the factors on which I base my confidence in ultimate success.

At both Nos. V. and VI. Camps we spent the evening in the hateful routine of high-altitude cooking.

It sounds simple. While one member of the party fetches snow from a neighbouring snow-bed his companion gets the cooker going and opens tins of food, such as pemmican, sardines, biscuits, jam, sweets, and tea. More trips to the snow-bed follow to enable thermos flasks to be filled for to-morrow's breakfast and climb, and for washing up.

I can give you no better idea of the conditions in which one works at these altitudes than by telling you that these apparently simple operations are most exhausting and call for some determination.

We spent very fair nights at both high camps; in fact, I slept really well at No. VI. Camp, which proves that we had learnt something of how to make the best of a high camp since the time two years before when four of us spent what I might describe as a most unfair night at 25,000 feet.

The first entry in my diary for June 4 is "Somervell pretty seedy with throat." I have already mentioned this throat trouble; it was much aggravated at these heights by the repeated intake of cold dry air catching the back of his throat.

He was handicapped by this throughout these three days. Late this same evening he very nearly choked, and was only saved by coughing up the obstructing matter along with a lot of blood. That he achieved what he did in this condition was a remarkable performance.

We started at 6.40 a.m., having been much delayed by the necessity of boiling snow for breakfast, for our thermos flask had got rid of its cork in the night, and shed its contents inside my sleeping-bag.

I have not much to say about the climb, and this not by reason of any dulling of the intellect or memory—for this is, I believe, a myth—but because there is so little to tell.

The weather was ideal, with singularly little wind. Even so, clad in two suits of windproof clothing and two sweaters, I found it very cold. Sitting in the sun I shivered so much that I once thought I had fever on me, and took my pulse. I was surprised to find it only some twenty above normal.

But against men in our condition the lack of oxygen was obstacle enough even in such favourable weather. Our pace was lamentably slow; on anything like a steep slope I consistently failed to realize my ambition of achieving twenty consecutive steps without pausing with fore-arm on bent knee, to puff and blow. Somervell's throat further slowed him down. We had to sit down and rest frequently.

So long as all went smoothly one achieved some degree of mechanical plodding, but trip or slip and the effort at recovery set one panting

furiously to make up for the deficit of oxygen caused by the extra exertion. Step-cutting in the rare patches of hard snow was exhausting work.

After a short distance on limestone scree and a few small snow-beds, we got on to the 1000-foot deep band of yellow sandstone which runs nearly horizontally across the whole face of the mountain. We traversed it diagonally, and headed for the base of the final pyramid, keeping below and roughly parallel to the crest of the north-east ridge all the way.

The going on this sandstone band was absolutely easy and almost devoid of snow until we approached the big couloir which cuts off the final pyramid from the great eastern shoulder of the mountain.

Here, at noon, Somervell finally succumbed to his throat trouble, and I went on alone.

I soon got on to much steeper rock as I turned a corner to enter the couloir. The slabs now were very narrow and sloping, like tiles on a roof; they were frequently covered with snow, which here was powdery like coarse salt and concealed without supporting. The general angle was steep enough to make a slip probably fatal.

I went very slowly and had more than once to retrace my steps and find another route; my rate of progress was also affected by the fact that I was beginning to see double—a premonitory symptom of snow-blindness, I suppose—with the result that by one o'clock I was but a short distance on the western or summit side of the big couloir, and perhaps 80 feet higher than where I left Somervell.

Here, in the shelter, the powdery snow was thickest, and I was confronted with a steep climb of some 200 feet before I could again traverse to the right and so gain the north face of the final pyramid and an easier gradient.

It was obvious I could not reach the summit in time to return in safety, and it was very doubtful if I had the strength to go so far in any case. So I turned back and rejoined Somervell by 2 p.m.

The view from the highest point we reached was, to me, disappointing, as is often the view from an aeroplane, for one looked down on all the surrounding mountains and the beauty of their outline was lost. It was a remarkably clear day, and one could detect snow peaks dimly appearing over the northern horizon like little teeth. They must have been hundreds of miles away.

The descent was uneventful for me, but very painful for Somervell. Nightfall found us on the big snow-bed a little below No. V. Camp, and the electric torch came into use; perhaps an hour later I succeeded in making myself heard at No. IV. Camp, whence we soon saw a light coming to meet us and a voice shouted that they were bringing an oxygen cylinder.

I shouted in reply again and again, "We don't want the d—d oxygen; we want drink." My own throat was not at its best, and I remember how feeble sounded my querulous wail, "We want drink! we want drink!"

losing itself in that vast waste of snow and ice glimmering under the stars. Odell and Mallory met us well above the North Col, and by 9.30 had escorted us into No. IV. Camp, where Irvine was brewing drink for dear life.

As we lay in our sleeping-bags that night Mallory told me how he had organized a new attempt with oxygen. He and Bruce had been down to No. III. Camp to try and collect sufficient porters for an attempt on a minimum scale. This they had done by making use of some of the men who had already been to No. V. Camp with them, supplemented by three or four others whom the continuance of fine-weather conditions had brought up to the scratch.

Mallory had arranged for Irvine to accompany him, and was prepared to start the next day but one. It will be remembered that Geoffrey Bruce was *hors de combat*. I was entirely in favour of the plan, which now represented our last chance of success.

The following morning I was snow-blind and took no further part in active operations. So I now leave Odell to tell the story of the final stage in which he played so notable a part.

## VI. THE LAST CLIMB OF MALLORY AND IRVINE

### N. E. Odell

Norton has described only too modestly his and Somervell's remarkable attempt on the summit and their return to the North Col on June 4, the same day that Mallory and Irvine had come up from Camp III. The latter had climbed the 2000 feet from Camp III. to Camp IV. in the fast time of two and a half hours, evidently in an endeavour to prove to themselves the efficacy of oxygen. June 5 was spent resting at the North Col camp, Irvine and I re-testing and putting final touches to the oxygen apparatus.

A few words may be said on the nature of Camp IV. and its surroundings. Perched on an ice-ledge in roughly the same position as the camp of 1922, it had four tents. A high wall of ice rising on the western side gave comforting protection from the prevailing chilly winds from that direction. The ledge was broad enough and long enough to allow comfortable movement all around the tents and leave an ample margin of clean snow for water-supply—a point that concerned me as camp cook. During my eleven days' residence there I experienced all sorts of weather conditions, not the least remarkable being two days when the sun temperature at midday was 105° F. while the air temperature at the same time was only 29°. I shall never forget some of the sunrise effects over the sea of peaks to the east, Chomo-Lönzo and Makalu standing supreme among them.

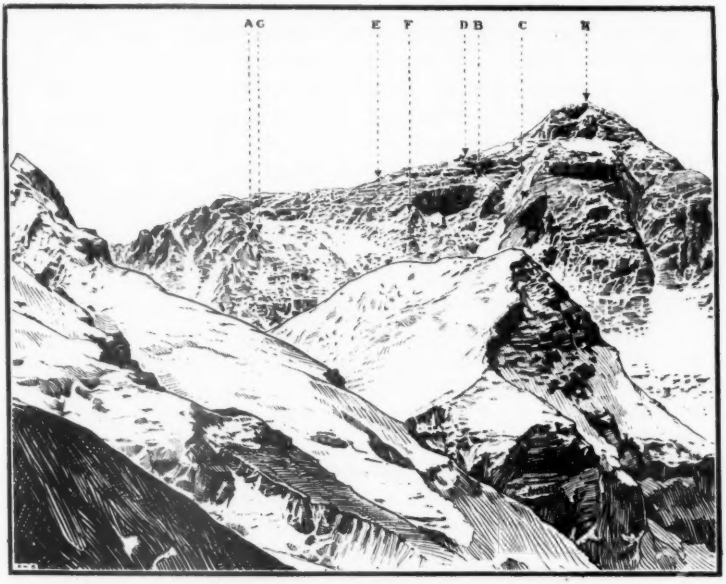
To reach the actual saddle of the North Col and the foot of the North Ridge of Mount Everest it had been necessary in 1922 to make a way from the camp ledge towards the North Peak and then back again along the crest of the col. On the occasion of our first reaching the site of Camp IV. on May 20, Mallory and I had forced a rather complicated route from the southern end of the ledge direct up to the col. This route, though a little treacherous from two doubtful snow-bridges, proved to be negotiable until the end.

At 8.40 on the morning of June 6, in brilliant weather, Mallory and Irvine left the North Col Camp for Camp V. They took with them five porters carrying provisions and reserve oxygen cylinders. They used oxygen, and in the opinion of the porters travelled well. On June 7, when they were going from Camp V. to VI., I went up in support to Camp V. with the one porter that was available. Soon after my arrival Mallory's four porters arrived from VI., bringing me a message which said that they had used but little oxygen to 27,000 feet, that the weather promised to be perfect for the morrow's climb, and that he was sorry the cooking stove had rolled down the mountain side just as they were leaving Camp V.—which meant a cold supper and breakfast for me. As Nema, my porter, was suffering from mountain sickness I sent him down with the four others to the North Col, and having the tent to myself and a couple of sleeping-bags, I kept sufficiently warm to sleep well that night. Next morning broke clear and not unduly cold. After a breakfast of cereals, and a little macaroni and tomatoes, I started my solitary climb to Camp VI., taking with me provisions for that camp in case of need. My plan was to make a rather circuitous route out on to the northern face, to examine the structure of the mountain. Mist soon began to form, and although the wind remained light I found myself immersed now and then in squalls of sleet and light snow. By the glow of light above me I could sometimes see that I was experiencing worse conditions than Mallory and Irvine probably were at their higher altitude.

At about 25,500 feet I came upon a limestone band which to my joy contained fossils—the first definite forms found on Everest. The lower part of the mountain is formed of a variety of gneisses, and on these rest a mass of rocks, mainly altered limestones, which compose the greater part of its upper half. Here and there have been intruded granitoid rocks, but these are relatively little in amount. The general dip of the series is about 30° northward, and since the slope of this face of the mountain above 25,000 feet is about 40° to 45°, the effect is to make a series of overlapping slabs nearly parallel with the slope and presenting a number of little cliff faces often up to 50 feet in height. These slabs are often sprinkled to a varying depth with *débris* from above, and when to this is added freshly fallen snow, the labour and toil of climbing at these altitudes may perhaps be imagined. It is not the technical difficulty

so much as the awkwardness of a slope usually not quite steep enough for the use of one's hands.

At about 26,000 feet I climbed a little crag, which could possibly have been circumvented, but which I decided to tackle direct, more perhaps as a test of my condition than for any other reason. There was perhaps 100 feet of it, and as I reached the top there was a sudden clearing above me and I saw the whole summit ridge and final peak of Everest unveiled. I noticed far away on a snow-slope leading up to the last step but one from the base of the final pyramid,* a tiny object moving and approaching the rock step. A second object followed, and then the first




MOUNT EVEREST FROM THE BASE CAMP

The drawing is made from a telephotograph taken at the Base Camp (16,500 feet) about 11 miles from the summit. The north-east shoulder (27,300) above A is half a mile nearer the Base Camp than the summit (29,002): consequently it appears relatively too high in the photograph, and the slope of the ridge too gentle.

A marks the position of Camp VI. (26,700 feet) and G the point reached by Mallory, Norton, and Somervell in 1922, which was probably misidentified and placed too high in the theodolite measures of 1922, made in very difficult circumstances; F just to the left of the dark patch is the point reached by Finch and Geoffrey Bruce in 1922. B is the point reached by Norton and Somervell in 1924, and the former went on to C. Mallory and Irvine were last seen at D, the "second step," the "first step" being at E. The identifications of these points have been made on the photograph by Colonel Norton.

climbed to the top of the step. As I stood intently watching this dramatic appearance, the scene became enveloped in cloud, and I could not

* Not the position indicated in illustration *Geogr. Journ.*, vol. 64, No. 2, opposite p. 160, but the rock step to the left of this beyond the snow patch.

actually be certain that I saw the second figure join the first. I was surprised above all to see them so late as this, namely 12.50, at a point that according to Mallory's schedule should have been reached by 10 a.m. at latest. I could see that they were moving expeditiously as if endeavouring to make up for lost time. True, they were moving one at a time over what was apparently but moderately difficult ground, but one cannot definitely conclude from this that they were roped—an important consideration in any estimate of what befell them. I had seen that there was a considerable quantity of new snow covering some of the upper rocks near the summit ridge, and this may well have caused delay in the ascent. Burdened as they undoubtedly were with the oxygen apparatus, these snow-covered *débris*-sprinkled slabs may have given much trouble. The oxygen apparatus itself may have needed repair or re-adjustment either before or after they left Camp VI., and so have delayed them. Or both these factors may have been operative.

I continued my way up to Camp VI., and on arrival there about two o'clock a rather severer blizzard set in and the wind increased. After a short rest I realized it was just possible that, baulked by earlier bad weather higher up, Mallory and Irvine might be returning, and the concealed position of Camp VI. would be almost impossible to discover in the blizzard. I remembered also that Mallory had told me in his note that he had left his compass at Camp V., and asked me to retrieve it. So I went out in the direction of the summit, and having scrambled up about 200 feet and yodelled and whistled meanwhile in case they happened to be within hearing, I then took shelter for a while behind a rock from the driving sleet. After about an hour's wait, realizing that the chances were altogether against their being within call, I found my way back to the tent. As I reached it the storm, which had lasted not more than two hours, blew over, and the whole north face of the mountain became bathed in sunshine. The upper crags were visible, but I could see no signs of the party. The little tent at Camp VI. was only just large enough for two, and if I remained and they returned, one of us would have had to sleep outside in the open—an altogether hazardous expedient. But apart from this, Mallory had particularly requested me in his last note to return to the North Col, as he specially wished to reach there himself after their climb. Leaving Camp VI. therefore about 4.30 and going down the north ridge in quick time, I took to the snow near Camp V. and glissaded down to the North Col, reaching the camp at 6.45. That night Hazard's brew of soup made from a mixture of at least six varieties went down really well. I was surprised, though, to find that I was not suffering from thirst—that bugbear of Everest—to anything like the extent I had expected.

We watched till late that night for some signs of Mallory and Irvine's return, or even an indication by flare of distress. Next morning we scrutinized through field glasses the tiny tents of Camps V. and VI.

far up above us in case they had returned late and had not yet started down. But no movement at all could be seen. At noon I decided to go up to Camp V., and on to VI. next day, and I arranged a code of signals with Hazard, who remained at the North Col. Two porters came with me and stayed the night at Camp V., but in the morning I had to send them back to the North Col on account of indisposition. It was a bitterly cold night and we slept little if at all. Using oxygen, I started off from Camp V., and when within an hour or so of VI. I came to the conclusion that I was deriving but little benefit from the oxygen, which I had been taking only in moderate quantities from the single cylinder that I carried. I switched it off and experienced none of the feelings of collapse and panting that one had been led to believe ought to result. On reaching the tent at VI. I found everything as I had left it: the tent had obviously not been touched since I was there two days previously. I dumped the oxygen apparatus and went in search along the probable route that Mallory and Irvine had taken. There was a bitterly cold west wind, and now and then I had to take shelter behind rocks to restore warmth. After a couple of hours' search I realized that the chances of finding the missing men were indeed small on such a vast expanse of crags and broken slabs, and that for any more extensive search towards the final pyramid a further party would have to be organized. I returned only too reluctantly to the tent, and then with considerable exertion dragged the two sleeping-bags up a precipitous snow patch plastered on the little crag above the tent. With these sleeping-bags placed against the snow I had arranged with Hazard to signal down to the North Col Camp the results of my search. It needed all my efforts to cut steps out over the snow-slope and then fix the sleeping-bags in position, so boisterous was the wind. But fortunately the signal was seen 4000 feet below, though the answering signal I could not make out. Closing up the tent and leaving its contents as my friends had left them, I glanced up at the mighty summit above me. It seemed to look down with cold indifference on me, and howl derision in wind gusts at my petition to yield up its secret, this mystery of my friends. If it were indeed the sacred ground of Chomo-lungma—Goddess Mother of the Mountains—had we violated it? was I now violating it? And yet as I gazed again there seemed to be something alluring in that towering presence: I was almost fascinated. I realized that no mere mountaineer alone could but be fascinated; that he who approaches close must ever be led on, and oblivious of all obstacles seek to reach that most sacred and highest place of all. It seemed that my friends must have been thus enchanted also: for why else should they tarry? In an effort to suppress my feelings, I turned my gaze downwards to the North Col far below, and I remembered that other of my companions would be anxiously awaiting my return, eager to hear what tidings I carried. Alone and in meditation I slowly commenced my long descent. But it

was no place for silent contemplation, for buffeted by storm-blasts that seemed to pierce one through, it needed all one's attention and calculation to negotiate safely the exposed slabs of the ridge and prevent a slip on their *débris*-sprinkled surfaces. I quickened my pace lower down, but at times found it necessary to seek protection from the biting gale behind rocks and assure myself that no symptoms of frostbite were imminent. Hazard had seen me coming, and sent his one remaining Sherpa to meet and welcome me at the foot of the ridge. Arrived at the North Col Camp I was pleased to find a note from Norton and to discover that I had anticipated his wishes that I should return to Camp IV. and not prolong my search on the mountain, seeing that the monsoon seemed likely to break at any moment. Next day Hazard, the porter, and myself, leaving the tents standing, evacuated the North Col Camp and went down in good weather to Camp III., and later in the day with Hingston and Shebbeare to II., reaching the Base Camp on the 12th.

I have already mentioned the possible reasons why Mallory and Irvine were so late in reaching the point at which they were last seen, at an altitude which Hazard later determined to be about 28,230 feet, and I must now very briefly speculate on the probable causes of their failure to return. They had about 800 feet to surmount to reach the top, and if no particularly difficult obstacle presented itself on the final pyramid they should have got there about 3 to 3.30. This would be three or four hours late on Mallory's schedule, and hence they would find it almost impossible to reach Camp VI. before nightfall, allowing five or six hours for the return. But at the same time it must be remembered there was a moon, though it rose rather late, and that evening it was fine and the mountain clear of mist as far as could be seen. In spite of this they may have missed the way and failed to find Camp VI., and in their overwrought condition sought shelter till daylight—a danger that Mallory, experienced mountaineer that he was, would be only too well aware of, but find himself powerless to resist: sleep at that altitude and in that degree of cold would almost certainly prove fatal.

The other possibility is that they met their death by falling. This implies that they were roped together, which need not be inferred from their observed movements when last seen. It is difficult for one who knew the skill and experience of George Mallory on all kinds and conditions of mountain ground, to believe that he fell. Of Sandy Irvine it can be said that, though altogether less experienced than Mallory, he had shown himself to be a natural adept and able to move safely and easily on rock and ice. Such had been my experience of him in Spitsbergen, Norway, and on our home mountains. They were hampered of course by the oxygen apparatus—a very serious load for climbing with —as Mallory had mentioned in his last note to me. But could such a pair fall, and where technically the climbing appeared so easy? Experts have done so, under stress of circumstances or exhaustion.

It has been suggested that the oxygen apparatus failed and thereby rendered them powerless to return. I cannot believe this, for from my own personal experience, to be deprived of oxygen—at any rate when one has not been using it freely—does not prevent one from continuing, and, least of all, getting down from the mountain. Mallory in his last note to me said they were using little oxygen, and that they hoped to take only two cylinders each from Camp VI.

Hence I incline to the view first expressed, that they met their death by being benighted. I know that Mallory had stated he would take no risks in any attempt on the final peak; but in action the desire to overcome, the craving for victory, may have been too strong for him. The knowledge of his own proved powers of endurance, and those of his companion, may have urged him to make a bold bid for the summit. Who of us that has wrestled with some Alpine giant in the teeth of a gale or in a race with the darkness, could hold back when such a victory, such a triumph of human endeavour, was within our grasp?

The question remains: "Has Mount Everest been climbed?" It must be left unanswered, for there is no evidence. But bearing in mind all the circumstances that I have set out above, and considering their position when last seen, I myself feel it is very probable that Mallory and Irvine succeeded. At that I must leave it.

A word in regard to the oxygen and the benefit derivable from it. I think that its importance has been exaggerated, and provided one has acclimatized at a sufficiently high altitude, say 22,000 or 23,000 feet, one can do practically as well without it. I am prepared to go further, and claim that oxygen used liberally may be regarded as a source of danger, preventing the user from proper acclimatization and greatly increasing the chances of his collapse if the apparatus break down. My own experience with the present apparatus is that its weight of about 30 lbs., combined with its bulk, quite obviates any advantage to be gained from it. It is interesting in this connection to compare Geoffrey Bruce's opinion in 1922 with his experience of it this year. I believe I am right in saying that he found he derived altogether less benefit from it this year than he expected he would. And this I feel sure was largely due to his higher degree of acclimatization. An interesting physiological point is that all members of the expedition who had been out before, acclimatized quicker than the new-comers. Finally, I consider that if oxygen be used by a high-climbing party in the future, if only in small quantities or as an emergency measure, it must be carried in an altogether lighter apparatus. Whether it be available in the gaseous state as at present, or can be carried in the much more convenient form of a liquid, is a matter for immediate research. But my firm belief is that Mount Everest can be climbed without oxygen.

## MEMORIAL SERVICE AT ST. PAUL'S CATHEDRAL

So soon as the tragic news that Mallory and Irvine had died on the mountain was published in a brief telegram on June 21, their colleges at Cambridge and Oxford arranged Memorial Services—at Magdalene on June 24 and at Merton on June 25; and on the following day a service was held at Birkenhead, from which town both came, and where their parents live. Several of Mallory's comrades on former expeditions members of the Mount Everest Committee, and the Joint Secretaries attended the services in the College Chapels, and Sir Francis Younghusband, the original chairman of the Committee, was present at the service in St. John's, Birkenhead. At this time nothing but the bare news of the accident was known.

When the tragic and glorious story of their climb to a record height within about 700 feet of the summit became known, it was evident that the celebrations of October 17, already fixed for the reception of the Expedition on their return, must assume a double character, of sorrow for the fallen, and high appreciation of the heroic exploits that marked those great days of June. It was therefore resolved by the Committee that the authorities of Saint Paul's should be asked to allow a solemn Memorial Service in the Cathedral, to precede the meeting in the evening at the Albert Hall.

This service was attended by great numbers of Fellows of the Society and Members of the Alpine Club, who filled the whole space under the Dome, and by a large congregation of the general public. His Majesty the King, the Prince of Wales, the Duke of York, and Prince Arthur of Connaught were represented. All the members of the 1924 expedition, and several of previous expeditions, were present, with the Mount Everest Committee, many members of the Council R.G.S. and of the Committee A.C., and delegates from many British Climbing Clubs. The lesson was read by the Dean; the full choir of the Cathedral sang the service; and the Bishop of Chester gave a most eloquent and moving address which, by his kind permission, we print in full. The Mount Everest Committee have expressed their thanks to the Dean and Canons of the Cathedral, and to the Bishop of Chester, for their most willing help in this solemn tribute to the memory of the two climbers who died on Mount Everest, perhaps in the very hour of their triumph.

## ADDRESS BY THE RIGHT REVEREND HENRY LUKE PAGET, D.D., LORD BISHOP OF CHESTER

*Ps. lxxxiv.* 5: "*In whose heart are Thy ways.*"

Many no doubt know what stands for these words in the Latin Version of the Psalms; a version used even more largely than ours,

and more familiar in its beauty to a vast number of our fellow-Christians—*Ascensiones in corde suo disposuit:* He has set ascents in his heart; or, as we should phrase it, He has set his heart on ascents.

It meant for the Psalmist no steep or dangerous climb. It meant at most a long and tedious journey, the sort of thing that is a venturesome undertaking to a quiet soul who lives at far distance from the Temple and the City of God. But it led him upwards, it led him to the place he wished to reach. Whether in memory or in anticipation, the road was dear to him. He had set his heart on it: he loved the upward path. It was fixed in his affection. *Ascensiones in corde suo disposuit.*

Far different from the attraction of that easy pilgrimage is the Challenge of the heights which has drawn into closest fellowship many of those who are here to-day. A great unanimity gives intense significance to your assembling in the House of God. For the lovers of the heights are a brotherhood more intimate, more closely united, more affectionately disposed to one another than almost any other group of men. It is as natural as it is beautiful that before your great meeting this evening you should meet here to remember, as in God's presence, those whose names are written in your Records in letters of gold.

It is not for us timid pedestrians to pretend that we understand your love of the heights. But if even from a distance and from some miserably lower level we have looked from afar upon the mountains, or known the silence of the snowfields, and the widening vision, and the exhilarating keenness of the air and the perfect azure of the skies (and you are good enough to believe that even the humblest climber may breathe the Spirit of the Mountains), can any one wonder at the fascination those mountains have for the real climber, that you have so set in your hearts the love of the heights? "Ascensiones in corde suo disposuit." Might it not almost be the motto of the Alpine Club?

It is simply because they both came from our county and diocese of Chester that I am asked to speak to-day. I am bidden, so far as such a thing is possible, to represent the homes from which they come, and those who love them best. They, I am sure, understand and value very highly what you wish to express by your presence. They are grateful to you for it. I got them to tell me something of the boyhood and early years of their glorious sons. In each instance there was the like story of quiet modest strength, of infinite perseverance, of a great and tender love of home, of a transparent purity of heart, of the deep and simple things that make fathers and mothers very thankful and very proud. I wish you could have been with us at Birkenhead, where, nearer home, an assembly not less significant, though it may be less august than this, tried to show its love for them and theirs.

And as we read what was so lovingly written, with all the eloquence of its reserve, it was not difficult to see in it the presage of what was to follow at Winchester and Shrewsbury, at Cambridge and Oxford, in the

Alps and in Spitsbergen, and at last on Mount Everest. It was the same Leigh-Mallory who veiled the grace and brilliancy of his leadership under the impenetrable cloak of his modesty; who when something like disaster occurred insisted on claiming responsibility for it, and when an incredible presence of mind on his part saved the lives of others never let us know that it was he; who reminded us that in a matter like this we all are comrades! Yes, and the same Andrew Irvine who, with all his brilliant, his amazing, his premature attainments as a climber, would laugh as he set himself to the humblest task, or use the splendour of his giant strength to bear the burdens of other men.

"Ascensiones in corde suo disposuit." Was it only the love of the high mountains that was set in hearts like these? No; but rather that with the love of the mountains was the ascent of spiritual altitudes, splendid peaks of courage and unselfishness and cheerfulness, such as are reached not necessarily by the surefooted and the clear-headed, but always by the compassionate, the brotherly, and the pure in heart.

For indeed the record of Mount Everest may well help men, if not to feel the mystery of the mountain, yet surely to enter more deeply, more reverently, into the spirit of the mountaineer.

Thankful as we are for what the Expedition is able to tell us of the way and the attempts and the great achievement and for its marvellous pictures, it is perhaps as a human record and a human document that it speaks most clearly and speaks to us in St. Paul's to-day. The indomitable cheerfulness, the amazing courage of it, the brotherly kindness and loyalty one to another, the passion for work, the refusal of praise. You have indeed set *Ascensiones* in our hearts: you have helped us more than you think to seek those things which are above; Whatsoever things are true and honourable, just and pure, lovely and of good report, if there be any manly virtue, if there be any praise, you have helped us to think on these things.

George Mallory, Andrew Irvine, lovely and pleasant in their lives, in death were not divided.

It seems as though when God means us to learn He is wont to clothe that by which He teaches us in some form of simple and solemn beauty, of which it is hard to mistake or resist the appeal. So it is here! The cloud clears away for a moment and you are allowed to see the two men making steadily and strongly for the summit. That is the last you see of them, and the question as to their reaching the summit is still unanswered; it will be solved some day. The merciless mountain gives no reply!

But that last ascent, with the beautiful mystery of its great enigma, stands for more than an heroic effort to climb a mountain, even though it be the highest in the world—*Sic itur ad astra.*

Think of it how you will: as the ascent by which the kingly spirit goes up to the House of the Lord; as the ascent through death to endless

life; as the ascent by which the men of clean hands and pure hearts ascend into the hill of the Lord and rise up in His Holy Place; as the way He went who said, "I go to prepare a place for you, that where I am there ye may be also."

> "Lofty designs must end in like effects,
> Loftily lying,
> Leave them—still loftier than the world suspects,
> Living and dying."

For they indeed go from strength to strength, who have set their hearts on the heights.

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## THE MOUNT EVEREST PHOTOGRAPHS

SINCE the main expedition followed exactly the same route as in 1922, the pictures sent home by Captain Noel and his collaborators in the photographic work of 1924 show for the most part scenes and incidents already familiar to us from the work of previous expeditions. The long route over the Jelep La into the Chumbi Valley and thence to the Rongbuk over the high Tibetan plateau by Kampa and Tinki and Shekar must be by this time the best photographed route in the world, and in the great collection of pictures stored at the Society there is material for study of scenery, costumes, architecture, and Lama ceremonial which is in great part still unworked.

From the great number of photographs already received this year—and there are more to come—we have with the help of Colonel Norton chosen a set which illustrate more particularly the detail of the mountain and its approaches. The highest pictures were taken by Mr. Somervell on his climb with Colonel Norton to over 28,000 feet without oxygen on June 3 and 4. Most of the others are believed to be by Mr. Bentley Beetham, but until Captain Noel's return there was some uncertainty about this, and we have been obliged to publish them without any attribution when they were not evidently by Mr. Somervell. Mr. Odell was, by an accident, without the use of his camera during his remarkable series of high climbs; and we shall never know what pictures may have been secured by Messrs. Mallory and Irvine.

Increased knowledge of the mountain has never shown more than one possible line of ascent: that found by Mallory, Bullock, and Wheeler in 1921. After the attempts of 1922 there was some talk of a possible alternative by getting at the North Col from the west; but no one has suggested a radically different way, and as the photographs become more successful the northern cliffs and north-west ridge (No. 1) look ever more formidable. The glacier below these cliffs is only about 19,000 feet above sea, the height of Camp II., and there does not seem to be much chance of establishing a series of higher camps on this side.

The fantastic ice-scenery of the East Rongbuk Glacier has lost nothing of the picturesque in the interval between the second and third expeditions. The ice-wall of the tributary glacier that comes in above Camp II. is there much the same ; but we do not recall anything in the 1922 pictures to equal the lake and ice pinnacles of Plate 2. In the evacuation of Camp III. at the end of the 1922 season Captain Morris described how with the onset of the monsoon the pinnacles were crashing and tumbling in all directions, so that in a few days the landscape was unrecognizable. It remains, we think, to be explained how pinnacles of this height, seemingly the remains of a thick glacier in rapid dissolution by evaporation or melting, are re-created from year to year.

A very remarkable feature, special to the East Rongbuk Glacier, is the " trough." In 1922 a route was made across it. This year the route followed it for a long way, and we may hope to have a detailed study of it. From first descriptions it seems to be connected with a medial moraine, which in its lower stretch appears upon the floor (No. 3), and at last rises up as an embankment above the general level of the glacier. The curious problem is, if it is a central moraine that is the prime cause of the trough, why is nothing of it visible where the trough starts ? It is described as dipping down gradually and smoothly from the nearly level surface of the glacier, with a smooth floor and steep walls that gradually get higher, until as in No. 4 it makes a smooth broad road of ice and snow among the pinnacles.

The lamentable experience of 1922 made it essential this year to choose a route to the North Col that should be free from risk of avalanche : and we are fortunate in being able to illustrate very clearly how this was done. Those who have read the dispatches will remember the chimney, and the rope ladder made for it by the " well-known firm of Odell and Irvine." No. 5 shows the bottom of the chimney and the lower end of the ladder, leading up out of the icy chasm that appears to the ignorant eye so wanton an exaggeration of the difficulties. But the reasons that compelled this difficult route are evident when we examine the following three pairs of pictures, wherein the lower of each pair has been marked by Colonel Norton to show the exact track that was made.

Photographs Nos. 6 and 7 show the ice-cliffs of the North Col, and the head of the East Rongbuk glacier, much more rugged than they have appeared before. The photographer has chosen the light to bring out the details of the crevasses in strong relief : so that it is not right to compare with No. 13 of October 1922 and No. 12 of December 1922, and to conclude that the ice-walls were more formidable this year than in 1922 ; they were much the same. But there is much evidence that the glacier had changed greatly. Col. Norton relates that he reached Camp III. this year in mist and snow. When it cleared away the scene seemed unfamiliar : for the upper reaches of the glacier were strangely

terraced, and standing up above the lateral moraine, looking different from the glacier of 1922.

Plate 6 is taken from somewhere just above Camp III. The route to the North Col lies along the lateral moraine, and to avoid the treacherous slopes turns away to the right behind the rock slope. It reappears, as marked in Plate 7, just at the critical point better studied in the succeeding pictures.

The leading principle in making the route seems to have been that safety from avalanches is secured on the lower edge of a crevasse. The long curved crevasse which in 1924 cut right across the principal ice-slope was well placed, but had a nasty break in its lower edge. The route (Nos. 8 and 9) gained the northern end of the crevasse and turned south along its eastern lower edge until it was forced to descend into the chasm (left-hand edge of Nos. 10 and 11, which are taken looking along the face of the col towards the mountain, nearly at right angles to the axes of 8 and 9). There are no pictures of the descent, but the floor of the crevasse is well shown in No. 4.

The rope ladder is shown in No. 10 leading up through the chimney to the broken lower edge of the great crevasse, seen very much foreshortened. The track bends away to the right round the curve of the ice-slope, and re-appears high up and far away in the top right-hand corner of No. 11, corresponding to the extreme top of the track marked on No. 9, which gives a clear view of the long section hidden in No. 11 by the curvature of the slope.

This was the normal route. In the quite desperate adventure of the rescue of the porters on May 24 Mr. Somervell followed the rather lower (chain-dotted) track in the upper part of No. 11; and after study of this photograph we may begin to appreciate what was involved in that rescue, or what it meant to bring Colonel Norton down snow-blind through the chimney on June 6.

Camp IV. was pitched nearly in the same place as in 1922, and Plate 6 of December 1922 is so like the photograph of the camp taken this year that it will serve very well to illustrate it. But there was one difference. It was no longer necessary to start towards Changtse in order to gain the north-east ridge of Mount Everest. The route shown in No. 7 led straight towards the mountain from Camp IV., but disappears from the sight of Camp III. soon after it has crossed the crevasse where presumably was the snow-bridge mentioned as insecure but sufficient.

No. 12 of the present series should be compared with No. 7 of December 1922 taken by Captain Finch. It is evidently taken from a point on the northern arête at about 25,000 feet: rather higher than the point from which Finch took his picture, as may be seen by comparison of the Lingtren peaks in front of Gyachung Kang, the high peak in the middle of the picture. The large mass to the left is Cho Uyo, and the twin peaks partly enveloped in cloud are probably Cho Rapsang, west

of the Khombu Pass, lettered BG and BF on No. 17 of October 1921. Mr. Hazard has now definitely confirmed Major Wheeler's position for the head of the West Rongbuk Glacier: it lies immediately below the cloud in No. 12 at the southern end of the slopes of Gyachung Kang. Here is an almost flat glacier pass, and the watershed runs from Lingtrennup (in the middle distance on the left) across to Gyachung Kang and on to Cho Uyo. The photographs which made the West Rongbuk Glacier appear to come from much further west are deceptive.

It is interesting to compare No. 12, taken at about 28,000 feet, with No. 3 of December 1922, taken at about 26,800 feet. In both the camera is pointed upwards, so that the slope is foreshortened and made to appear much less steep than it is. The line of the arête between the smoother snow and the rocky face shows that No. 12 is taken further to the left than No. 3: the arrangement of the horizontal bands shows that it is taken much higher up. In No. 3 of December 1922 there are heavy rocks in the foreground. Just above the left-hand corner of the top rock is seen the "second step" reached by Mallory and Irvine. Below and to the right of this are dark patches, which can be easily identified in our present No. 12, wherein Norton is seen in the middle distance approaching a cleft between two black pieces of cliff. In the older picture Norton's position would be about 0·4 inch right and 0·3 inch down from the edge of the second step. He went on and got across the great couloir which comes down from the foot of the final pyramid, but gained little more in height, and estimated that he was nearer 300 feet than 100 below the second step: he disclaims the 28,200 feet attributed to him in the title of Pate 12; it was nearer 28,100.

All the photographs of the high climbing in both years show this very unattractive ground on the northern face of the mountain, rough slabby stuff, rarely difficult in the technical sense, but dangerous from thin snow and loose scree on slabs awkwardly tilted. Only Mallory and Irvine have ever reached the crest of the ridge between the summit and the north-east shoulder. They alone have looked down the cliffs which are shown in the telephotograph taken by Mallory himself in 1921 (No. 8 December 1921). It will be necessary to have this negative examined under magnification, to see if it is possible to identify the detail on the ridge. Somewhere near, and probably to the left of the black marking on the skyline, is the second step; and if they fell it may be on this side that they lie.

The most interesting of all, in many ways, is No. 14, taken by Somervell from 28,000 feet looking northward clear over Changtse to the main Rongbuk Valley. The Base Camp is somewhere about the patches of snow near the upper edge and the left-hand corner. Camp I. is below the sharp snow peak, Camp II. beyond the tributary glacier's junction with the East Rongbuk. Camp III. is somewhere in the right-hand bottom corner, and Camp IV. on a ledge just to the right of and below

the narrow North Col which stretches across the foreground with steep rock on the left and equally steep ice-cliffs on the right. It is instructive to compare this picture with No. 6. It has seemed a puzzle how the North-Col ice was fed, for the slopes above it are mostly bare rock, and the photographs gave the impression of a great thickness of ice on a rather flat top. It now looks as if the substructure of the col is a knife-edge reaching really to the level of the ice on its western edge; and that all the mass of ice on its eastern slope may be fed from the snow accumulating in the lee of the col during the prevailing westerly winds. The black summit on the left overlooking the Rongbuk Valley is what looks like the summit of Changtse (the North Peak) in front of the cloud in No. 1. It is not the summit, which lies away to the left in No. 1, and in No. 14 is somewhere, not easily identifiable, on the ridge that runs almost vertically below the snow peak, probably at the junction with the long straight crest that goes off to the right in front of the East Rongbuk Glacier.

Plate 15 is taken from the same point as No. 14, but looking westward and rather more towards the south than No. 12, so that Gyachung Kang comes on the right-hand edge, and the view just includes in the left-hand top corner a high dark mountain that must be Gaurisankar, though as that mountain is some 3000 feet lower than Cho Uyo and twice as far away, it is clear that the camera must be tilted, and the picture too high on the left. The fine peak a little to the left of the centre is Pumori; the other peaks await identification from Wheeler's map as completed by the last expedition: not quite an easy matter, as the Lingtren peaks are from this aspect confusingly unlike the view of them from the Rongbuk Glacier.

Finally, No. 16 shows a pious deed well done. Dr. Kellas in 1921, seven porters in 1922, Mallory, Irvine, and a Gurkha N.C.O., have fallen in the reconnaissance and the two seasons of assault. The monument to their memory erected before the expedition left the Base Camp in 1924 will be revisited in 1926: and we like to hope that the climbers safe returned from the summit in that year may be able to add a sentence to the inscription, that Mallory and Irvine died after reaching the summit in 1924. That would seem to be the most fitting end to the great adventure whose third stage is recorded and illustrated in this number of the *Journal*.

The sketch-map which follows page 504 has been made from the surveys of Major Wheeler in 1921, with various additions from the work of the 1924 expedition, and occasional correction from photographs. The principal geographical result of this year is to confirm the result of Major Wheeler in 1921, that the West Rongbuk glacier comes from a very flat glacier pass south of Gyachung Kang, and that the glacier beyond descends steeply into Nepal.

## THE GRAND COULEE AND THE COLUMBIA BASIN IRRIGATION PROJECT

For the photographs illustrating this account of the Grand Coulee, and for much useful information we are indebted to Mr. Thomas R. Horner of Seattle. It is in the main based upon the following works:

BAULIG, H., "Les plateaux de lave du Washington Central" (*Ann. de Geog.*, 22, 1913; 49–59).

CALKINS, F. C., 'Geology and Water Resources of East Central Washington' (Water Supply Paper, U.S. Geological Survey, No. 118). 1905.

RUSSELL, J. C., 'Geological Reconnaissance in Central Washington' (U.S. Geological Survey, Bulletin No. 108). 1893.

*Journal of Geography*, Washington Number, May 1916.

'Columbia Basin Project.' A report by Columbia Basin Survey Commission, State of Washington. Olympia: 1920.

'Columbia Basin Project: State of Washington.' A report by George W. Goethals and Company, Inc. to the . . . State of Washington. Olympia: 1922.

The last two publications were obtained from the Columbia Basin Survey Commission, through the courtesy of the Bureau of Reclamation, Dept. of the Interior, Washington.

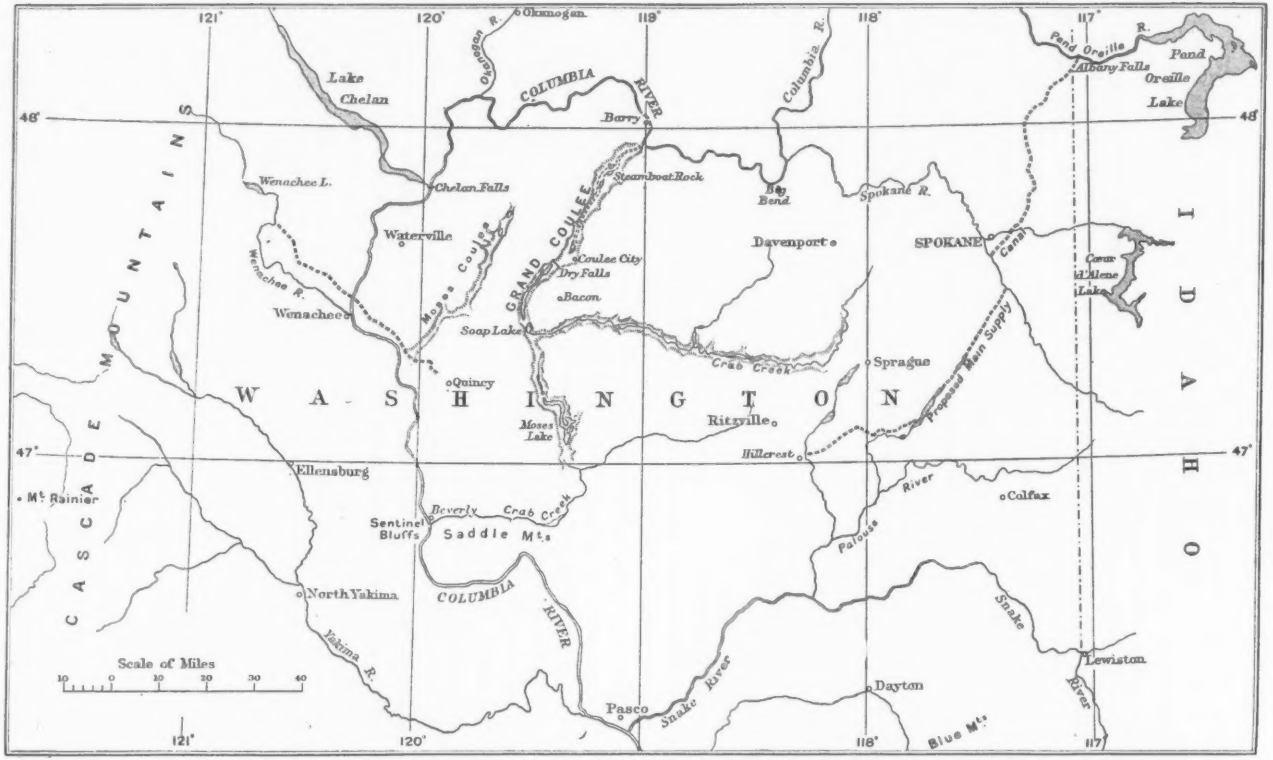
EASTERN Washington is covered by one of the largest lava-flows in the world. It extends from the "Big Bend" of the Columbia River southwards into Idaho and Oregon, and eastwards into Montana. That portion lying in eastern Washington is usually known as "the Great Plains of the Columbia." The actual western boundary of the system is not the Columbia River, but the Cascade Mountains further west, which rise to an average height of 6500 feet, with several peaks, among them Mount Rainier, over 10,000 feet high. To the north these mountains, decreasing in elevation, merge into the Okanogan Highlands. Through these the Okanogan River flows to join the Columbia west of the "Big Bend." On the east the boundary is formed by the western spurs of the Rocky Mountains, including the Cœur d'Alène Mountains, where the Pend Oreille and Spokane rivers, also tributaries of the Columbia, rise. Southwards the basalt slopes away into the deserts of southern Washington, where the Snake River and the Blue Mountains of Oregon form a natural limit. In reference to this region, the term "plains" is used in a general sense, for there is a difference of many hundred feet between its highest and lowest portions; but as the rise is comparatively gentle and the characteristics of a wide rolling expanse are preserved throughout, this use can be justified.

The main topographic features of the area are the basaltic plateaux in the north and north-east, 2000 to 3000 feet above sea-level. The whole region is intersected by numerous creeks and coulées running generally towards the Columbia or Snake rivers. The most considerable of these is Crab Creek, though it is not continuous. It rises in the east and runs in a general south-westerly direction, until diverted due

west by the Saddle Mountain to join the Columbia gorge near Beverly. These coulées are dry-river canyons of varying size, eroded by rain when the climate was much moister, or by water from the melting glaciers at the close of the Ice Age.

The flood of basaltic lava, the outstanding geological feature of this region, took place in Miocene times. It was not to any great extent the result of violent volcanic eruption. Some lava poured forth from once active volcanoes in the Cascade Mountains, for example from Mount Rainier, but the general absence of volcanic dust and ashes prove that such eruptions were the exception. It is probable that most of the molten lava welled up through fissures in the Earth's surface. These fissures, now filled up with solidified lava, have been exposed by subsequent erosion, and can be examined, notably in the region of the Cascade Mountains. This covering of lava, which in places is calculated to have covered the underlying metamorphic and crystalline rocks to a depth of 2000 feet, was not the result of one continuous flow. In later ages the Snake and Columbia rivers carved their gorges through it, and on their sides it is now possible to distinguish many separate layers. At Sentinel Bluffs, on the Columbia, twenty such flows can be counted, averaging from 50 to 100 feet in depth. That considerable periods of time often elapsed between these flows is shown by the occurrence in certain areas of intermediary bands of soil and the charred remains of trees, and in later series of beds of volcanic ash and gravel. After the last flow the lava was subjected to considerable orogenic movement, which, with the erosion noted above, produced the present topographical features.

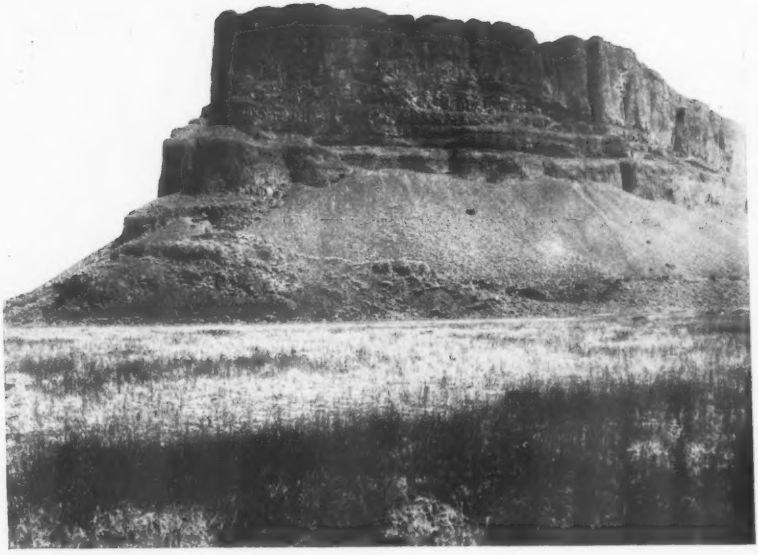
A change in the climate then took place, and with few exceptions the streams ceased to be perennial. Their dry valleys are now called "coulées." During the succeeding Glacial Age the surface of the basalt was still further eroded. The final surface features are the work of the wind. The soil, comparable to the loess of Northern China, consists of very fine particles covering the bedrock in places to a depth of 20 feet. This has been driven by the wind to cover up the sides of the smaller coulées and to form low sandhills. Prof. Russell, in his work cited above, contends that the soil of the plains is residual, consisting of decomposed basalt and other sediments deposited by a great lake which he held to have covered them once, and to which he gave the name of Lake John Day. Calkins, however, is inclined to extend the action of the wind to account for all the soil of the plains, arguing from its nature and from the sharp division between it and the underlying basalt that its origin must be æolian. The Grand Coulee differs in origin from the other numerous coulées scattered over the plains. Its history begins in the Glacial period. While the ice-sheet which covered North America was gradually pushing southwards, a glacier descended the Okanogan Valley and crossed the Columbia gorge. The Columbia River, thus dammed up, broke southwards below the "Big Bend," probably




Columbia Basin Irrigation Project, Eastern Washington.

UPPER COULEE AND STEAMBOAT ROCK

THE UPPER COULEE AND THE COLUMBIA RIVER



STEAMBOAT ROCK, UPPER COULEE

GRAND COULEE

THE DRY FALLS, GRAND COULEE

LOOKING SOUTH FROM THE DRY FALLS

BELOW THE DRY FALLS

THE DRY FALLS FROM THE SOUTH

along a fault line, and scouring out a bed in the basalt, flowed into Crab Creek, rejoining its former course to the north of the Saddle Mountains, about 100 miles lower down. On the recession of the ice-sheet the Columbia returned to its original bed, which has been eroded to a much lower level than when the river was diverted, so that the floor of the Grand Coulee, at its northern end, is now about 600 feet above the level of the Columbia. The Grand Coulee was thus the temporary bed of the Columbia during the Glacial period. The southern limit of the Okanogan Glacier is marked by a series of low ridges, the remains of its terminal moraine, which run in a wide curve, convex to the south, from Chelan Falls to a point 5 miles north of Coulee City. Scattered over the plains, and along the floor of the Grand Coulee are many boulders of basalt, and a lesser number of granite, deposited there by the ice. The eastern edge of the Okanogan glacier coincided with the Grand Coulee. As the ice reached it large masses would break off, and, carried away by the Columbia, must have added considerably to its scouring power. The superior rate of erosion of the Columbia, thus augmented, probably accounts for the existence of numerous "hanging valleys" along the edge of the Grand Coulee. This ice-action may also be the explanation of the greater wearing down of the western edge of the floor of the coulée: most of its lakes lie under the western wall. As has been noted above, with the exception of the Grand Coulee, all the beds of the coulées were eroded by ordinary surface streams. Moses Coulee, between the Columbia and the Grand Coulee, was probably carved out by the water from the retreating glacier. The valley of Crab Creek was of course considerably enlarged during its occupation by the Columbia. The Grand Coulee, from the interest of its geological history, its characteristic scenery, and the use to which it is suggested it might be put, deserves more detailed description.

The Grand Coulee may be divided into two well-marked sections, the Upper and the Lower. The Upper Coulee leaves the canyon of the Columbia near the village of Barry and runs south-west for 30 miles to Coulee City. At the northern end its floor is 600 feet above the level of the Columbia. Here the coulée is from 5 to 6 miles wide, though further south it narrows considerably. The greater width of its northern end is due to the basalt being much thinner there, so that it has been more easily eroded, displaying the underlying granite. The floor of the coulée slopes slightly to the west, and its western side is occupied by marshes and small lakes, some of which are saline. The walls are perpendicular, 400 to 600 feet high, with their base covered by talus. A prominent feature is Steamboat Rock. This is an "island" in the middle of the coulée with sides 400 feet high, and a flat top of 600 acres. Its sides show signs of the eroding powers of the Columbia. Numerous "hanging valleys," 200 to 300 feet deep, are also to be seen in the sides of the coulée.

The Upper Coulee maintains its flat bottom, its width, and its vertical walls with remarkable uniformity until it approaches Coulee City. North of this point the eastern wall of the Upper Coulee subsides, and it is joined by a broad shallow valley. The western wall continues at the same elevation. It is, however, banked up to a considerable height by talus, so that the ascent to the western plateau is comparatively easy. This is the only place where the Grand Coulee can be crossed—a fact which accounts for the situation of Coulee City.

Two miles below Coulee City the eastern wall reforms again, though at a lower level. Its top is now roughly level with the floor of the Upper Coulee, while the western wall maintains its former elevation. The difference in the level of the floors of the Upper and Lower Coulees was the cause of the waterfall, now dry, known as the "Grand Falls of the Columbia." This dry fall is a sheer precipice of 450 feet. It is about a mile in width, and is composed of five horseshoe curves. At its foot is a deep lake, many potholes and embayments, originally the work of the waters of the Columbia, but now filled by the rains. The force of the falling water has wrought the rock into fantastic shapes. The prehistoric falls must have rivalled Niagara, and the scene remains striking to-day. South of the "Dry Falls," the Lower Coulee becomes more irregular: after 15 miles it debouches into the sandy valley of Crab Creek, though the western wall continues for some distance at a considerable elevation. For the next 30 miles the bed of Crab Creek is occupied by a string of lakes, probably formed by sand-dunes blocking its course. Moses Lake, the largest, is slightly saline. Soap Lake, so called because its waters contain a large quantity of soda salts in solution, is becoming well known. It has now a sanatorium, and is one of the popular health resorts of the north-west. South of Moses Lake, the creek, after disappearing underground for some distance, comes to the surface again and turns due west, and after 30 miles joins the Columbia canyon. It is probable that the rocky channel of the Lower Coulee continues along the line of Crab Creek and Moses Lake, though hidden from view by the surface débris.

The soil of the Great Plains, being rich in potash, is very fertile. Owing to the dryness of the climate—the average annual rainfall ranges from 12–14 inches in the north to less than 8 inches in the south, the average January temperature being 35° F. and the July 75° F.—the vegetation is scanty, consisting of sage-bush and bunch-grass. Formerly, therefore, the plains were only used for the raising of cattle and horses. Where water can be obtained wheat can be grown very successfully. These conditions have led to the development of the system known as "dry farming." Its principle consists in preventing the infiltration of the moisture into the subsoil, surface evaporation, or waste through weeds, and in allowing the land to lie fallow alternate years, in order to collect sufficient moisture to grow a crop. This system has proved

successful in the moister districts, but it is obvious that, given a sufficient supply of water, the yield there could be increased threefold at the least, while the total area under cultivation could be greatly extended. With the object of accomplishing this by bringing the water of the Columbia to the Plains, irrigation schemes have been worked out, in one of which the Grand Coulee plays a part.

The Columbia Basin irrigation project is concerned with an area lying between the Columbia and Snake rivers, varying from 1,153,000 to 1,753,000 acres, in the most arid part of Washington. Three schemes have been examined in this connection: (1) The Pend Oreille gravity scheme; (2) the Columbia River pumping project; (3) the Wenatchee Lake project.

Though the George M. Goethals Company have reported in favour of the first scheme, the Columbia pumping project is noticed in some detail here on account of the part which the Grand Coulee would play in it. The main feature of the first scheme is the utilization of the watershed of the Pend Oreille River, a tributary of the Columbia, above Albany Falls, and, more particularly, Flathead and Pend Oreille Lakes. From a dam at Albany Falls it would be necessary to construct a main supply canal running south to Spokane and then south-west to the south-eastern corner of the reclamation area, a total length of approximately 130 miles. The proposed course would require the construction of seven dams and eight tunnels, of which the longest would be 16 miles, besides an aqueduct over the Spokane River east of Spokane. In some cases tunnels have been preferred to canals, as they would conserve the water better. From Hillcrest the water would be distributed over the area by three main systems: the northern, running north-west between Soap Lake and Moses Lake to Quincy; the central, west to the Saddle Mountains; and the southern, south-west parallel with Snake River. These three canals, with their laterals, concrete lined throughout, would have a total length of over 900 miles. Where coulées or railway lines have to be crossed, steel inverted syphons would be employed if possible. No great danger is anticipated from the waterlogging of the land owing to the numerous coulées, at present dry, which would lead off the surplus water. The final positions of the lateral canals are designed so that between almost every pair of laterals there is a line of natural drainage. Six years is the time estimated as necessary for the completion of the scheme at a cost of 254 million dollars, equivalent to $145 per acre of irrigated land, while the annual operating cost would be $841,000 or $0·48 per acre.

The Columbia pumping project is based upon the utilization of the Upper Coulee as a great artificial reservoir. As the floor of the coulée is 600 feet above the Columbia River, it would be impossible to build a dam sufficiently high to operate the system by gravity flow without the water escaping higher up the river; nor would it be possible to place the

dam further upstream and lead the water by canal to the coulée, owing to the nature of the edge of the Columbia's canyon. The alternative would be to construct a lower dam at the head of the coulée, and raise the water to it by pumping. It has been calculated that a dam 180 feet above average low water would provide sufficient power for direct pumping. To raise the necessary water the remaining 480 feet would require thirty-three turbines of 30,000 horsepower each, operating an equal number of 84-inch two-stage centrifugal pumps. Sufficient water would thus be raised to convert the Upper Coulee, closed at either end by a dam, into a great reservoir. The doubtful point in this scheme is the construction of the Columbia River dam. The Columbia at this point does not flow over rock; there is probably 200 feet of glacial gravel in its bed. If there were but 100 feet, 5,000,000 cubic yards of cement would be required for the foundations of the dam, whose crest length would then be 3100 feet.

From the Coulee City dam the supply canal would run south through a tunnel into an artificial lake north-east of Bacon. At this point the water would be distributed by two canal systems. The course of the western main would be almost identical with that of the northern branch of the Pend Oreille scheme. It would apparently cross the lower section of the Grand Coulee by means of a great inverted steel siphon, costing about $3,000,000. The second main would run southwards for nearly 20 miles, and then to the south-east, its distributing system corresponding roughly with that of the southern section of the Pend Oreille scheme. The Columbia pumping project would irrigate about 1,403,000 acres at a cost of $250,000,000, or $178 per acre. The annual operating cost, owing to the complicated machinery at the Columbia dam, would average $1·5 per acre.

The third scheme, the Wenatchee Lake–Quincy project, contemplates using the lake which lies to the west of the Columbia River as a reservoir, carrying the water across that river to the area south of Quincy. This scheme would only irrigate 410,000 acres, part of which lie to the west of the Columbia. It is not considered in the later report.

The following reasons led the George W. Goethals Company to report in favour of the Pend Oreille Gravity Project against the Columbia River Pumping Project: (1) The former develops the greater acreage; (2) the construction cost per acre is lower; (3) the annual operating cost would be much lower; (4) the general superiority of a gravity flow over a pumping scheme; (5) the avoidance of international complications. Under the treaty of 1846 between Great Britain and the United States, navigation on the Columbia River from the international boundary must be free and open. This would at least necessitate the building of a complicated series of locks to pass vessels through the Columbia dam.

The recent history of the scheme dates from 1919, when the State of

Washington organized the Columbia Basin Survey Commission to investigate its possibilities. The Report of the Commission, made the following year, was reviewed by engineers of the Bureau of Reclamation, at the request of State officials. In 1923 Congress authorized the Secretary of the Interior to investigate the project, and appropriated $100,000 for this purpose. The Secretary has accordingly instructed the Bureau of Reclamation to proceed with the investigation, and has appointed a committee of three to consider and report on it.

## GEODESY AND GEOPHYSICS AT MADRID

THE Second General Assembly of the International Union of Geodesy and Geophysics was held at Madrid in the most delightful circumstances. A fortnight of perfect weather: a city new to most of the delegates: the gracious interest and hospitality of the King and Queen: the thrill of life under a military Directory: the sumptuous accommodation of the Palacio del Congreso consequently vacant: lavish official hospitality, untiring private courtesies, a first-rate organization, and a full scientific programme, combined to make it the most pleasant international meeting within our recollection.

And the geodesists were particularly happy, for the experience and forethought of their executive Committee had decreed that they should meet a week early, and get through a great part of their work before the official entertainments began to make agreeable inroads on the time of the Congress. When the seismologists and magneticians, the meteorologists, vulcanologists, and hydrologists arrived, the geodesists were already old inhabitants of Madrid. They had behind them nearly a week of hard work—from 9 a.m. to 8 p.m. their President declared the Section had deliberated; they had passed a Sunday of official "repose" in being taken 100 miles in motors to the Palace of El Pardo and the Monastery of El Escorial, with sumptuous entertainment by the way; they had slipped into the Prado every spare half-hour, accustomed themselves to dining at ten, and were thoroughly acclimatized. They had enjoyed for a week the crisp exhilarating air of fine early autumn, and were convinced that the climate of Madrid is maligned. And when they saw that not even the arrival of the meteorologists could interrupt the serenity of brilliant sunrises, cloudless days, and perfect evening glows, they rejoiced in the new *régime* of the International Research Council, and remembered without regret how differently managed the weather had often been in the old days before the war.

Some twenty British delegates were distributed among seven sections; and the results of their labours will be published in the *Travaux* of the Union. We must wait for a balanced account of their work as a whole, and this brief preliminary note can deal only

with some incidents of the section of Geodesy, in which our Society was more particularly interested.

The Section of Geodesy was strongly attended: perhaps one-half of all the delegates belonged to it, if some had in the second week to divide their allegiance. It was most happy in its President and its Bureau: Mr. William Bowie, Chief of the Division of Geodesy, U.S. Coast and Geodetic Survey, M. Gautier of Geneva, the single Vice-President, and Colonel Georges Perrier the Secretary, with an enviable power of making business plain and speaking French without acceleration. It would be going too far to say that all the delegates understood what was going on all the time; but if there were sometimes a Spaniard who failed to follow a Japanese talking excellent English, or a Peruvian rather puzzled by an Englishman talking indifferent French, self-sacrificing delegates strove valiantly as interpreters, and it was a great advantage to all, except perhaps some of the Scandinavians, that there were only two languages in general use.

The presentation of National Reports is a feature of these meetings which takes a good deal of time, and has been known to be tedious: but this also has been changed by the European War. The restoration of Poland, the new orientation of the Succession States, the advent of France in Syria, the destruction by war of Struve's great arc-of-meridian stations, have put new life into geodesy on our side of the Atlantic. Struve's arc—of which, we are surprised to learn, even the stations in Scandinavia are mostly lost—can be replaced in great part by the junction of modern triangulations in Norway and Sweden, Poland, Czecho-Slovakia, Yugo-Slavia, Italy, and Greece. Before that is completed Egypt should have extended her triangulation coastwise to her western frontier, and plans have already been discussed for the junction of Greece with Africa *viâ* Crete. The avowed object is to join up with the "Cape to Cairo" arc of meridian. It is therefore incumbent upon the British to remember that Sir David Gill's great scheme for an African arc on the 30th meridian is still very far from complete. It stopped short for lack of money 70 miles south of Tanganyika. The long gap through the Tanganyika territory to the Uganda–Congo arc now falls to us to do, and to work northwards from the Semliki through Uganda and the Sudan to the frontier of Egypt. Nothing was said about this at Madrid, but it would be a very good thing if something hopeful could be reported three years hence at Prague.

The best news of the East came from Siam, which was able to report completion of a quite considerable arc of meridian, soon to be extended. The section was not slow to grasp the importance of this striking piece of work; and besides congratulating the Royal Survey Department of Siam, passed a formal resolution urging the Governments of India and of Indo-China to lose no time in making geodetic connection with Siam.

From across the Atlantic came first the habitual report of rapid and

continuous progress in the United States Coast and Geodetic Survey, pursued with unflagging energy and what seems to us boundless resources. There is the less need to attempt here a condensation of Mr. Bowie's report, in that on his way home he stayed for a few days in London, and very kindly gave to a small special meeting of British geodesists a most interesting account of the modern methods and the projects of his department, which we hope to publish later. But it was gratifying to note at Madrid that the work of this great Survey, with its eighteen mathematicians at headquarters and a proportional establishment of engineers in the field, no longer completely overshadows the smaller and poorer but no less active surveys of others in North America. The Geodetic Survey of Canada was represented by its Director, Mr. Neil Ogilvie, who could report immense progress, greatest in the last few years, but dating twenty years back to the issue of a famous but temporarily unpopular report by the late Colonel Edmund Hills. It was pleasant for old friends of his to hear from Mr. Ogilvie that the scheme now being pursued with so much success and with so great advantage to the Dominion is essentially the scheme which Hills made. By a thoroughly sensible agreement made in conversation at a former geodetic congress, the United States Standard Datum at Meade's Ranch has become the North American Standard Datum, and the whole triangulation of Canada, the United States, and Mexico is being built as an organic whole, on the Clarke spheroid of 1866. A smaller example of sound judgement comes from Ecuador, where the triangulation is planned to connect with and extend the French re-measurement of the "Arc de Pérou."

Such excellent results spring from the informal discussions and personal friendships engendered by an international conference. When the conference attempts in plenary session to decide a complicated and controversial question the results may be less happy—or at any rate seem less happy to the unsuccessful side. The adoption of a Standard Figure of the Earth had been proposed at Rome, and relegated for decision at Madrid after study and report by the Executive Committee. Our readers will remember an exhaustive discussion at the Afternoon Meeting of the Society in May last (*Geographical Journal*, August 1924, Paper by Mr. G. T. McCaw) which revealed wide differences of opinion in those who spoke. Some were for Clarke 1866, some for Clarke 1880, and some for a conventional figure in round numbers; but none were for Hayford 1910, which was eventually chosen at Madrid. It came about in this way: The Executive Committee recommended Hayford 1910. A British delegate put up what he hoped was a strong case for Clarke 1880, supported by an imposing series of diagrams reproduced for distribution by a friendly colleague. The Executive Committee replied by *ex parte* statements that the weight of Hayford was very much superior, and the reciprocal of Clarke's flattening very much too small—

allegations that the said diagrams were designed to refute. After a long discussion one morning the President decided to abandon a decision, since no agreement seemed possible, and he held—at any rate in conversation—that a decision unless nearly unanimous is valueless, because nobody is really bound by it. That afternoon the delegates were invited to take a glass of champagne at the Geographical Institute, and the discussion was continued fiercely in little groups. Towards night the exponent of Clarke 1880 was told by his colleagues that he might consider himself suppressed, and that in the morning he must vote for a conventional figure: which he did, but in vain, for Hayford's figure received nineteen votes of those who happened to be present at the moment, against seventeen for the round number; and thus 6378388 and 1/297 became figures sanctified by the authority of the International Union of Geodesy and Geophysics.

This is no occasion to argue the scientific merits of the decision: that will be done elsewhere. But there is something to be said on the broad principles that should, we think, be invoked in such a situation. Many would argue that in face of strong opposition no decision should be taken at all, and this would be in accordance with the best precedents. There was, however, a strong demand for a settlement. That being so, it might have been better to secure that the voting should be really representative: that full notice should have been given that the vote would be taken at a certain hour: that the questions to be put to the vote should have been committed to writing, and in the hands of all the delegates at least the day before. Without these precautions, it is always a little doubtful whether the figures of a narrow division, on a complex scientific subject, in an assembly that has no common language, have really the weight that should attach to the pronouncement of an International Union.

But no doubts such as these can mar our conviction that the meeting at Madrid was a triumph for its organizers: for the President and officers of the General Committee, for the Bureaux of the Sections, and especially for our hosts. The Spanish Committee, headed by Don Luis Cubillo and Señor Galbis, left nothing to chance, and they infused into their careful organization of detail a distinguished courtesy which will live long in our memories.

The Meeting was honoured by the Patronage of His Majesty King Alfonso the Thirteenth, who presided at the opening section, and afterwards received in audience the President and Officers. Moreover, the whole of the delegates and their ladies were on the Saturday evening commanded to the Royal Palace and graciously received by the King and Queen, who spoke with each.

It is hard to express how deeply the Conference appreciated the signal honour thus done them by their Majesties, or to put in words their thanks to the Spanish Government who made the most liberal provision for

the reception and entertainment of the delegates and their ladies, and gave them a marvellous opportunity to see something of the wealth of architecture and art in the capital city, at the Escorial, at Toledo, Aranjuez, el Pardo; and finally, after the Congress, in the cities of the South. They set up a standard of considerate hospitality which it will be hard to maintain.

A. R. H.

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## A DEVICE FOR OBSERVING STARS WITH THE THEODOLITE WITHOUT CROSS-WIRES OR FIELD ILLUMINATION

E. A. Reeves, Map Curator and Instructor in Survey, R.G.S.

WHEN observing stars with a theodolite the illumination of the field is frequently a matter of considerable difficulty and inconvenience, resulting in serious delay at critical moments. To obtain just the correct amount of light that the cross-wires and star may be seen at the same time is not easy by the ordinary methods of illumination. Either the field is too bright, so that the star cannot be seen well, or too faint, so that the wires are not clearly visible. Even the latest electric lighting devices are often very troublesome, and in the wilds, when it is impossible to obtain new dry cells or get accumulators recharged, frequently fail altogether. Other devices, such as illumination of a paper reflector by a hand lamp, are more or less makeshifts.

I have for some time past been endeavouring to devise means of overcoming these difficulties, and after many experiments have succeeded in constructing a simple attachment which can be fitted to any theodolite, and observations can be taken without any illumination of the field if the object-glass is fairly large. Two images of the star are visible in the telescope, one seen by direct vision and the other by double reflection, and these coincide, and appear as one star, only when the star is exactly in the centre of the field. In any other position the images part and move in opposite directions. This double and opposite movement increases the accuracy of the observation, since if the star is not in the centre of the field the distance the images are apart is double the error of pointing. This device should also be of use in mines and other underground works where lamps have to be used as marks upon which to sight the theodolite.

Two small thin circular glasses are lightly silvered on one side so that they transmit a part of the light and reflect the rest. One of these is placed in the focal plane of the telescope, and takes the place of the ordinary diaphragm, and the other screws over the eye-lens of the eyepiece. In the circular fitting of the eyepiece reflector there are four

capstan-headed screws, two vertical and two horizontal, to give the necessary means of adjusting the reflector.

The optical principle is simple. The first image of the star is formed on the silvered face of the diaphragm. The transmitted light passes through the eyepiece and emerges as a parallel beam on the eye-lens reflector. Part of this beam is reflected back through the eyepiece, and forms a second real image of the star on the silvered face of the diaphragm. The reflection backwards and forwards between the two reflectors is repeated indefinitely with decreasing intensity; but in a 5-inch theodolite the third and following images are invisible.

This device does not interfere in the least with the construction of the telescope, and can be readily fitted to any theodolite. When it is required for use, take out the ordinary diaphragm by the usual extractor provided and replace it by the reflecting diaphragm. Then screw the eyepiece reflector over the eyepiece, and the theodolite is ready for taking observations. A comparatively low-power eyepiece is more suitable than one of high power, and the theodolite should have a large objective.

With a 5-inch theodolite (by Casella & Co., who have fitted this attachment for me) with an object glass of $1\frac{1}{4}$ inch aperture, the direct and reflected images are clearly visible and coincidences can readily be made with 1st and 2nd magnitude stars, and on good nights smaller stars have been observed with this instrument.

The telescope is focussed by turning the screws which move the object glass and eyepiece until both images appear as fine points, and do not move relatively to one another when the eye is moved. When this is so, all that remains to be done is to turn the vertical and horizontal tangent screws until the images exactly coincide, and note the times, level readings and altitudes in the ordinary manner.

The adjustment of the half-silvered reflector over the eye-lens is readily made, and when made is not easily disturbed. The theodolite, with the ordinary cross-wire diaphragm, must first be brought into adjustment in the usual way, by reversal on a distant mark. The reflectors are then placed in position and the process repeated, using this time only the adjusting screws of the eye-lens reflector to set it perpendicular to the optical axis. Any residual errors of adjustment are eliminated in the ordinary way by observation on the two faces.

The partly silvered mirrors must be on glass worked flat, and the silver protected from tarnish by thin flat cover glasses cemented with Canada balsam. These mirrors have been made by Messrs. Adam Hilger.

*Note on Mr. Reeves' Invention.*

The optical theory of Mr. Reeves' ingenious and beautiful device requires a little consideration. At first sight it appears that the optical axis of the instrument is defined as the perpendicular from the second principal point of the object glass to the reflector over the eye-lens. and that the diaphragm-reflector

need not be strictly perpendicular to this axis so long as both the primary and secondary images of the star are in focus on the partly silvered surface of this reflector. Critical focussing is evidently necessary, and one has not the usual advantage of being able to focus the eyepiece first on the cross-wires, and complete the focussing with the objective-screw only. It would seem essential that the focussing should not be touched between the reversals of the instrument, and that there should be no possibility of shake in the eyepiece.

The loss of brightness in the primary and secondary images, and the relation between the two, depend on the amount of silver on the reflectors. Assuming that they are similar, that they transmit a fraction $n$ of the incident light and reflect the remainder $1 - n$, losing nothing by absorption, and assuming further that no light is lost by reflection and absorption in the eyepiece, then it is clear that the intensity of the primary image is $n^2$ and of the secondary $n^2(1 - n)^2$ of the intensity in the ordinary arrangement without reflectors. The apparent diminution of magnitude of the stars would then be

| | | | | |
|---|---|---|---|---|
| $n = \frac{1}{4}$ | First image | 3·0 mag. | Second image | 3·6 mag. |
| ,, $\frac{1}{3}$ | ,, | 2·4 ,, | ,, | 3·3 ,, |
| ,, $\frac{1}{2}$ | ,, | 1·5 ,, | ,, | 3·0 ,, |
| ,, $\frac{2}{3}$ | ,, | 0·9 ,, | ,, | 3·3 ,, |
| ,, $\frac{3}{4}$ | ,, | 0·6 ,, | ,, | 3·6 ,, |

The most favourable result, if brightness of the second image is the main consideration, would thus be given by a mirror which transmits half the light and reflects half. But this result will be affected by the absorption of light in the silver film, and by differences in the reflecting power of the two sides, as well as by losses in the eyepiece. In any case it would seem that the second image must be at least 3 magnitudes fainter than the single star in a dark field. It might be advantageous to secure greater equality of the images, even at the expense of further loss to the second star. A. R. H.

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## REVIEWS

### EUROPE

**Hill Towns of the Pyrenees.— Amy Oakley.** Illustrations by **Thornton Oakley.** London: John Long, Ltd. 1924. $8\frac{1}{2} \times 5\frac{1}{2}$, pp. xxvi + 449. *12s. net.*

THE author and the illustrator of this book have evidently covered the French and Spanish Pyrenees thoroughly. With considerable skill they have blended together what would appear, judging from recent works, to be the necessary ingredients of an up-to-date "travel book"—description, incident, history, and high spirits, with a slight idiomatic flavour in the prose. Yet, but for the excellent pen-and-ink drawings, there is little to make it stand apart from many another made after a similar recipe. The author describes herself as a "traveller of gentle birth"; her route, therefore, never diverged far from the motor road. At Luchon, indeed, she particularly notes that the "charm" of the mountains triumphed over that of the Casino. The narrative ends on the beach at Biarritz.

**A Pilgrim in Spain.— Aubrey F. G. Bell.** London: Methuen & Co. 1924. $9 \times 5\frac{1}{2}$, pp. 240. 20 *Illustrations and Map.* *12s. 6d. net.*

From his hermit home on the banks of the Tagus Mr. Aubrey Bell has produced another interesting volume on his favourite country, Spain. It

aims at reproducing the atmosphere of the chief cities of Spain, particularly Seville, Cordoba, Granada, and Madrid. It may be thought that Mr. Bell is more successful in his treatment of village life and peasant habits of thought than in his portrayal of the more strenuous existence of the larger cities. While the casual traveller will find the book interesting, it will appeal with greater force to one who knows the language, the history, and the literature of Spain, for an extensive if not exhaustive study of these Mr. Bell rightly considers a necessary preliminary to a full appreciation of the country and its people. Naturally, few controversial subjects are dealt with, and although the book abounds in historical allusions the political situation is left untouched. It may be doubted however whether, as Mr. Bell believes, bull-fighting is destined to be replaced by the pelota. It would appear to be more probable that the rising generation of Spaniards will satisfy their sporting instincts on the tennis-court and the football-ground, for both in Madrid and in Seville matches already draw larger crowds than the bull-ring can accommodate.

G. B. B.

ASIA

**Shelton of Tibet.— F. B. Shelton:** New York: George H. Doran Company. 1923. 7½ × 5, pp. xiv. + 320. *Illustrations.* $2 *net.*

In this book the writer gives some account of the work of her husband, an American Baptist Medical Missionary, mainly in Southern Tibet, where he lost his life by mischance on one of his journeys in the interior. A considerable part is composed of letters from relatives and friends, and while the volume as a whole scarcely lends itself to anything in the nature of a formal review, it contains several items of unfamiliar interest.

A singularly detailed familiarity with human anatomy appears to prevail among the common folk. It is declared that "perhaps there is no people on the globe who know so much about the construction of the body as the Tibetans, and yet who have so little medical knowledge or so few remedies. The facts of anatomy are learned from one of their modes of burial, the body being dissected and fed to the birds."

Illness of all kinds is believed to be the work of evil spirits, hence the importance assumed by the "devil dances" and similar forms of exorcism, to which attention was drawn in the remarkable moving pictures and their accompanying music by Dr. Howard Somervell in the lectures descriptive of the second Everest expedition.

A further terror to life for the Tibetan, and his helplessness in the face of the unseen, are disclosed in the firm and widespread belief in the ability of his enemy to "*pray him to death*"!

In the prevalence of superstitions so universal and so malignant, ample justification is afforded for work such as that undertaken by Mr. Shelton—work which aims at enlightening the minds of this people with a teaching that brings a new outlook on life and some of its problems, and furnishes them with the means of remedying many of the physical ills to which human flesh is heir.

W. W.

**South Indian Hours.— Oswald J. Couldrey, I.E.S.** (retired). London: Hurst & Blackett, Ltd. 1924. 8½ × 5½, pp. 288. *Illustrated by the Author.* 18*s. net.*

The part of India between the Eastern Ghats and the mouths of the sacred Godavari is out of the beaten track of travellers, and was accessible with difficulty before the opening of the East Coast Railway in 1900. At Rajahmundry, a country town just above the head of the delta, Mr. Couldrey spent

most of his ten years in India, and found a solace for exile in studying, with exceptional sympathy and insight, the country and its people—"an imaginative experience of the first and finest water." The picture he draws of this bit of India is full of reality and colour; geography, history, and literature provide him with abundant parallels to things Indian; his writing is scholarly, with frequent touches of humour, and in the portion of the book that was written in India, sometimes whimsical. As geography, the description of the seasons in Telingana is quite admirable, but it is much better than mere geography.

The second part of the book describes some of the great temples of the South—the Tamil land that was the India of the older picture books; the land of "palms and pagodas." The descriptions are not simply architectural: those of Madura and Chidambaram, in particular, make one realize the part these temples play as social institutions. In the third part of the book we have a chapter on caste and its social implications, in which an interesting view is expressed on the unhappy question of racial feeling. Mr. Couldrey says, "My experience leads me to attribute racial differences . . . far more to tradition and circumstance and far less to innate racial qualities than has hitherto been usual." The author touches with pleasant humour on matters of sport from the point of view of one who was never a "shikari" except by compulsion or circumstances. The last chapter, "The Far Past," describes some of the ruined "temple-cities" of South India. A picturesque account is given of the remarkable site of Vijayanagar, the capital of the "Forgotten Empire" that for more than two centuries was the bulwark of the Hinduism of the south against Muhamadanism pressing down from the north. It is owing to this forgotten empire that Tamil India has remained a country of great temples. Mr. Couldrey's book has both value and charm, and the illustrations, by his own hand, are of much interest. W. H. A. W.

**Anatolica.**— **H. C. Luke.** London: Macmillan & Co., Ltd. 1924. 9 × 5¼. Pp. xii. + 210. *Illustrated.* 16*s. net.*

Mr. Luke, now, we believe, stationed on an African shore, had had long and very various experience of the Near East, on both sides of the Bosphorus, at both ends of the Black Sea, in more than one Mediterranean land, and so long in one Mediterranean isle that, in literature, since Mallock's day in the 'eighties, he has almost made it his own. In more than one charming book he has already sketched a town here, a district there, with a touch which always adorns, and a learning and a sympathy which are out of the common. His is ever a light touch. He seems almost too continually conscious that *l'art d'ennuyer c'est tout dire.* He is a photographer who believes only in snap-shots. The result is that he has stimulated an appetite, served up piquant *hors d'œuvres,* and then whisked the cloth away just as we began to look for solids. In this latest volume he is a little more considerate of our cravings than usual. Though Parts I. and III. are of his habitual texture—trifles light as air—Parts II. and IV., which treat of Cyprus and Transcaucasia, aim at more satisfaction. The last, not only because it describes less familiar scenes, is his most welcome contribution to popular geography; but perhaps the most thorough bit of work in the volume—the one which best illustrates his obedience to a scientific conscience—is the chapter on Famagusta. But still he closes his essays leaving us hungry. We have just time to learn how light is his hand and how keen and discerning his taste, and—the meal is over! Will he some day credit his readers with being just a little more robust and serve them with just a little more meat? D. G. H.

**Trans-Jordan.— Mrs. Steuart Erskine.** London: Ernest Benn, Limited. 1924. 9½ × 6, pp. 126. *Illustrations.* 12*s.* 6*d. net.*

Lord Raglan, in a short Introduction, writes that Mrs. Erskine has produced "a very readable book, containing much historical information, and calculated to give the reader a good general idea of the present condition of the country." This description of the volume is fair, but does not enough emphasize the delightfully understanding and sympathetic attitude of the author towards the inhabitants—Arabs and Circassians—and it omits to mention the very excellent illustrations from photographs which so greatly add to the value of the book. The writer travelled from Jerusalem to es Salt and thence to Ammon. Here she had the good fortune to join a well-escorted party (to which Sir Ronald and Lady Storrs belonged) on a visit to Petra and Kerak. From the latter place she returned to Jerusalem *via* Ammon and Jerash. The past greatness and vitality of the land is here contrasted with its present stagnation and lapse into comparative barbarism. Mrs. Erskine's journey coincided with the visit of King Hussein, and belongs to a period when hope was still ascendant and the British still fairly popular. One of the most satisfactory organizations mentioned is the "Arab Legion" under the leadership of Peake Pasha. There is a photograph of this body of men—so entirely suited to the anomalous condition of the land—by King Hussein at Amman. On the general political outlook of Transjordania the author has not much to say that is encouraging, and Lord Raglan in the Introduction is even more pessimistic. It must be admitted that recent events have justified such an attitude. It seems impossible that things can be left as they are. Unfortunately, entire removal of British control would almost certainly mean the destruction, within a few years, of the remaining beautiful ruins of Græco-Roman civilization. With regard to the tourist, conditions of security are considerably worse now than the last few years before the war. E. W. G. M.

AFRICA

**Across the Sahara by Motor Car.— G. M. Haardt** and **L. Audouin-Dubreuil.** London: Fisher Unwin. 1924. 9½ × 6, pp. 256. 12*s.* 6*d.*

This book contains the official account of the first motor journey across the Sahara undertaken in 1922–23 by five Citroen cars equipped with Kegresse caterpillar treads. The story is simply and unaffectedly told, and, in French, makes good reading. Like M. Haardt himself the description of the journey is straightforward and unassuming, and altogether what one would expect from a traveller who is obviously in love with his subject. It is unfortunately harder to discern these qualities in the English version of the book, as the translation can by no means be praised. The translator has so little understood his subject that he even copies faithfully such curious words as Tessefists (p. 56), which in French military slang means wireless operators (from the initials of *T*élégraphie *S*ans *F*ils). Most of the transliterations are slovenly—the French in any case are none too careful about this at any time—and all the names are in French forms. Taken in conjunction with the continuous use of the narrative present tense, which does not suit our language, the impression which this volume will probably leave on the mind of a casual reader is one of exasperation.

M. Haardt is probably right when he says that the motor car has come to revolutionize even the life of the nomad of the desert; there are nevertheless still some places where the Citroen-Kegresse car cannot go, and the reviewer, for one, is rather glad of it. The track of the cars across the Sahara from Tuggurt to Timbuktu by way of In Salah and Tamanghasset in Ahaggar is

shown on an adequate map at the end of the volume, which is also properly indexed. The time employed on the outward journey was from 17 December 1922 to 7 January 1923; the cars after a short stay on the Niger returned the same way north, and reached Tuggurt once more on March 6 with no more serious mishaps than could be put right by a few running repairs. The expedition claims to have conquered the desert, and a certain colour is lent to the vaunt if we are to believe the rumours which are in circulation to the effect that the Citroen company is about to organize a Trans-Saharan Tourist Service. But the cars have not really conquered the Sahara yet, for this and similar trips will remain *tours de force* so long as subsidiary expeditions have to be sent out to form petrol dumps, and when so great a proportion of the useful load of the machines has to be devoted to carrying fuel, etc. It is in no sense an economic proposition, as the authors suggest, nor does it provide a solution to the controversy surrounding the utility of a trans-Saharan railway. Neither goods from the Sudan nor men for the French Colonial army can profitably be carried across the desert so long as the Citroen Company feels obliged to charge even one-tenth of the price reported to have been fixed for the tourist tickets on the forthcoming journeys, which are to cost each passenger 10,000 frs.

The volume gives a good picture of the Tuareg in their homes in the desert. There is nothing very new in the way of anthropological information, and the descriptions are luckily objective in tone. The most charming parts of the book are those devoted to stories of the Tuareg, and more especially to their poetry, collected in the course of the journey. F. R.

**Geological Survey of Nigeria. Bulletin No. 5. The Tinfields of Nassarawa and Ilorin Provinces.— C. Raeburn.** 1924. 10 × 8, pp. 63. *Plates I.–VI. and Geological Maps (of both fields, one coloured).*

**The Same. Bulletin No. 6. The Nigerian Coalfield, Section I. Enugu Area.— A. D. N. Bain,** with Appendices by **R. Bullen Newton** and **A. C. Seward.** 1924. Pp. 81. *Plates I.–X. and Geological Map.*

**The Same. Bulletin No. 7. The Phosphate Deposits of Abeokuta Province.— W. Russ.** Note by **C. W. Andrews.** 1924. Pp. 43. *Plates I.–VI., also Sections and Geological Map.*

The first Report deals with the ground lying to the west of the Bauchi Plateau proper, well known as the chief home of Nigerian tin, and more briefly with the much smaller area in Ilorin. The tablelands, west of the Bauchi Plateau, consist of deeply incised country, studded with granite hills, and on north and south bounded by faults having a west to south-west trend.

Some interesting plates are given of the scenery, and also photomicrographs, by Mr. Sweeting, of some of the principal rocks. The later geological history of the Nassarawa area is briefly discussed. After the intrusion of the "Younger Granite," as the final phase in an extensive series of acid rocks, came a long period of erosion and the deposition of a "Fluvio-volcanic Series," here but poorly represented, consisting of red earth, varying in colour with the proportion of iron oxide present and in texture with that of the quartz. The next stage was the elevation of the Bauchi Plateau, when much of this series was removed. Finally came the renewal of volcanic activity and the outpouring of floods of basalt, which may once have covered the country about 14 miles from the present southerly outcrop of volcanic rock.

The volcanic rocks associated with the earlier Series, the author suggests, may be "the first evidences of the instability which produced the Tertiary crustal movements."

The happy discovery of coal at Udi by Mr. Kitson and Dr. Teale in 1909,

the fortunate finding of Port Harcourt, and the subsequent building of the Eastern Railway provided Nigeria with a commodity of inestimable value, amounting in 1920, the year of maximum output, to over 5000 tons a week. Mr. Bain's Report, which is illustrated by a coloured Geological Map and excellent plates, is therefore very welcome. The age of the coal still remains doubtful, but the evidence points clearly to an Upper Cretaceous or early Tertiary date, the coal on the eastern side of the Niger and the lignites on the western being parts of a continuous period of deposition. At Enugu the physical features fall into three divisions: the eastern plains, stretching, densely bush-clad, to the Cross River, the sharp escarpment rising to the Udi Plateau in places 1000 feet above the lower ground, and the plateau itself. This escarpment, an important feature of the Southern Province, has been traced for about 100 miles, while on the highlands west of Enugu lies one of the "major watersheds" of Nigeria dividing the drainage to the Cross River from that to the Niger. The area has a considerable interest not only for the geologist but also for the student of geography.

It is no easy matter to carry on work of a geographical or geological nature in the dense bush of the southern part of Nigeria, and there is little wonder that the phosphate deposits now found to occur on the Western Railway, halfway from Lagos to Abeokuta, remained undiscovered until a diversion of the line drove cuttings through them. Plate I., Fig. 1 of Mr. Russ's report gives a typical view of the vegetation. The deposits are of Eocene Age and are believed to be due to a marine fauna which existed during periods of local depression, when the sea encroached on a coast where lagoon and shallow-water conditions previously (and afterwards) existed. The subject is treated fully, and completely illustrated; an Appendix by the late Dr. Andrews gives interesting particulars about the vertebræ of a snake, referable to an English Eocene genus, from these deposits. On this evidence, the beds are believed to be "probably older than the London Clay." The interest of all this country is considerable, if one would understand fully the sequence of events which attended the formation of phosphates and bitumen in the south and of lignite coal in the north.

Dr. Falconer and his Staff are to be congratulated on these three additions to our knowledge of Nigeria.

J. P.

**A Woman alone in Kenya, Uganda, and the Belgian Congo.— Etta Close.** London: Constable & Co. 1924. 7 × 5, pp. 288. *8s. 6d. net.*

This account of eighteen months' experiences in East Africa makes excellent reading. Miss Close stayed on settlers' farms, visited Nairobi and other centres of white population; with a Dutchman as head of her safari spent some time in the region between Mount Kenya and the Guaso Nyiro; passed through the Uganda Protectorate and made a short trek west of Lake Albert, in the Kilo gold-mines district of the Belgian Congo. She is a close and accurate observer, and writes with sympathetic insight of the various types of settlers whom she met. There are certain character sketches drawn with much skill. Miss Close's comments on what she saw in the Belgian Congo are very pertinent, but, perhaps unconsciously, she writes as if in the very small corner of the Belgian Congo she saw were centred all Belgian interests in that vast territory, which is far from being the case. This is the only blemish we find in a very interesting book, save that the sketch-map given is not sufficiently clear.

F. R. C.

AMERICA

**The Spanish South-West, 1542–1794.**— An Annotated Bibliography by **Henry R. Wagner.** Berkeley [Cal.]. 1924. 13 × 9½, pp. 302.

In 1917 Mr. Henry R. Wagner published at Santiago, Chile, a list of works in Spanish relating to that part of the United States which was formerly Mexican. The present volume is in a sense an amplification of the earlier one but may perhaps be more fitly regarded as a new work; for whereas the list of 1917 was a pamphlet of some 40 pages without a title-page, 'The Spanish South-West' is a stately volume of 300 pages with numerous reproductions. Mr. Wagner's aim has been to produce an annotated bibliography of the early literature of his chosen region, and in doing so he has made several important departures from his original plan. In the new work he no longer confines himself entirely to Spanish books, though these naturally still form the majority; moreover, he now gives later editions and translations of a work instead of, as formerly, mentioning only the original edition. The notes also form an important new feature, and there are many facsimiles of title-pages. The method of arrangement is chronological in the main, though the various editions of a book are grouped together instead of being placed in each case under the year of issue, a plan which in spite of certain drawbacks has much to recommend it.

The entries in this elaborate list range in date from 1542 to 1794. Mr. Wagner is modest in his claims and pays a handsome tribute in his introduction to Don José Toribio Medina, to whose various bibliographical works he owns himself much indebted. It is evident, however, that Mr. Wagner's work is the result of many years of painstaking research on his own part, and he is to be congratulated on the result of his labours. He is of course fortunate in being himself the possessor of a fine collection of books on which he has been able to draw largely for his material. The notes which follow the bibliographical details are in some cases of an exhaustive nature, especially in the earlier entries; for instance, the bibliographical description of the first book, the 'Relacion' of Cabeza de Vaca of 1542, is followed by eight pages of notes. The English books dealt with are not numerous, and are usually translations from a Spanish or French original. To English readers the most interesting entries will perhaps be those relating to Sir Francis Drake, of whose voyage round the world Mr. Wagner has made a special study from the bibliographical point of view. A special word of praise is due to the general appearance of this imposing volume, which is an important contribution to the literature of its subject; it is beautifully printed on fine paper, and, apart from its weight, is a book which it is a pleasure to handle.

F. P. S.

**The Southern Sierras of California.**— **C. F. Saunders.** London: Hutchinson & Co. 1924. 8 × 5, pp. xii. + 367. *Illustrated.* 16*s. net.*

The proximity of untouched areas of great natural beauty to the centres of the Pacific coast must make life very pleasant for their inhabitants. Before long, however, the roads beloved of Trade Boards must break through these solitudes. Mr. Saunders determined to explore and record their delights before that foreshadowed invasion. Sauntering away very casually one morning from Pasenda—he very commendably refuses to "hike"—he is soon wandering through almost virgin forest, rock scrambling, or making the acquaintance of some very delightful characters. Throughout this collection of sketches the human side comes first, enthusiastic botanist though the

writer is. Down and out prospectors, casual roadside acquaintances, innkeepers, all reveal their true selves to Mr. Saunders. What his secret was we may perhaps guess from the imprint on these pages of a quiet, modest, yet determined personality, with a fund of restrained humour. His sympathies also enable him to construct from local tradition convincing and attractive sketches of the figures of the past—Spanish friars and explorers, Federal soldiers, "forty-niners"—who successively pushed across these mountains.

**The New World: Problems in Political Economy.— I. Bowman.** New edition. London: Harrap & Co., Ltd. 1924. 10 × 6½, vi. + 630 + 112. *Maps and Illustrations.* 21*s. net.*

To the original work issued in 1921 and fully reviewed at the time in this *Journal* (vol. 59, pp. 215–218) Prof. Bowman has added a Supplement and an Appendix. The Supplement deals more fully with American affairs, which are analysed very clearly and with much candour. The fundamental factor underlying the present position of America, internally and externally, is the reaching of the limit of territorial expansion. At home this means inability to continue to absorb foreign immigrants and an aggravation of the urban problem. Abroad it has led to economic, in place of territorial, expansion, which has led to virtual domination of the Caribbean. In the wider sphere of world politics this substitution has not, in the author's opinion, exempted the United States from foreign entanglements. The various recent attempts to settle both this financial and other world problems are set out in the Appendix.

## AUSTRALASIA AND PACIFIC ISLANDS

**The Land of the Sun.— E. J. Brady.** London: Edward Arnold & Co. 1924. 7½ × 5, pp. 303. *Illustrations and a Map.* 7*s.* 6*d. net.*

The land of the sun is Northern Queensland, one of the parts of Australia which the author clearly knows well. To him it is a veritable paradise in which all is fair. There can be no doubt about his enthusiasm; every page from beginning to end is written in a superlative vein with scarcely a single note of criticism. The author's disjointed style and his frequent irrelevancy are a little wearisome to one who does not share his feelings and is anxious to learn about Queensland. A good deal of information is contained in the pages, but we doubt if many readers will have the patience to find it.

**Pearls and Savages.— Captain Frank Hurley.** London: G. P. Putnam's Sons. 1924. 11 × 7½, pp. xiii. + 414. *Illustrations.* 31*s.* 6*d.*

Capt. Hurley gives a vivid popular account of his travels in various parts of British New Guinea and Torres Straits, and his descriptions of the scenery, condition and life of the natives, diving for pearls, hunting the dugong, and so forth, will interest geographers as well as the general public. The expedition is memorable from the fact that it was the first to employ seaplanes in New Guinea for geographical purposes, and the author secured a number of fascinating pictures, but the only one here reproduced is that of the Purari delta village of Kaimari, which is most instructive. Although there is in his text very little that is novel to those who have read the existing literature on the places he visited, yet much of his information will be novel to others. The book is well illustrated by eighty superb photographs, and these afford many pictures of natives and ethnographical data which will be valued by students, and they render the book well worth having. We are informed that "Ethnologists are confounded regarding the origin of the Torres Straits islanders, and the aborigines of New Guinea. Beyond conjectural hypothesis or theory there is

no record of history." The racial history of most parts of the world would be a blank were it dependent upon "history," and that of the remainder would be imperfect and of doubtful value. Ethnologists flatter themselves that the racial history of Torres Straits and New Guinea is gradually being elucidated, but admit there is much more to be found out. Capt. Hurley unfortunately revives the opinion so often expressed that there is a Jewish element in the western Papuans; speaking of the natives of Lake Murray he says, "The cast of features of these people is amazingly Hebraic. . . . They coincided accurately with historians' description of the lost ten tribes of Israel and might well pass for bronzed Babylonian Jews." One would like a reference to these historians. It seems that this guess solely rests upon the fact that many western Papuans have convex noses. The visit to Urama is graphically described, and as this district has been but meagrely referred to by others, any information is welcome. The photographs of a great ceremonial house show details that link it with the Purari Gulf cultures, and although it was known that skulls in these buildings were placed in "pigeon-holes," no photograph depicting this custom had previously been taken, and we are also made acquainted with a new and remarkable type of mask. Capt. Hurley concludes by saying, "So my hopes were realized, I had seen the people of the fabled lake. . . . This was the first time white men had ever sailed these reaches; the first time white men had ever seen these people." This statement may be true to the extent that his party evidently went to a part of Lake Murray that had not been previously visited. As a matter of fact, Governor Murray first visited Lake Murray in April 1914, and in his Report for that year he states that it was "so named by its discoverers Messrs. Massey-Baker and Burrows in June last year," and, as it has been visited subsequently, it seems a misuse of words to term it "fabled." The new information about the lake and its inhabitants (apart from the photographs) does not add materially to what has been published in the Annual Reports, Papua. The book is essentially of a "popular" nature, but most of the information it contains is trustworthy. A. C. H.

GENERAL

**Grundzüge der Länderkunde.— Alfred Hettner.** Band I. Europa. 2nd (revised) edition, pp. viii. + 389, 4 pl. and 197 maps in text.—Band II. Aussereuropäische Erdteile, pp. vi. + 438, 193 figs. in text. Leipzig and Berlin: B. G. Teubner. 1923.

Modern text-books of the regional geography of the world on a university standard are few in number, and we can only regret that this excellent work is in the German and not in the English language. For it appears to the reviewer to be the best book of its kind in any language, treating as it does of all the aspects of geography in a well-balanced manner.

Prof. Hettner has had long experience as explorer, traveller, editor, and teacher—a combination peculiarly favourable to the development of sound judgment in geographical matters and their presentation. Moreover, we learn from the preface to the second volume that the author had worked for thirty years on this part—the world beyond Europe—before he thought it ready for publication. Part I., published in 1907, has at the same time been revised and brought up to date; this second edition of the European volume, however, does not differ substantially from its predecessor save in the treatment of political aspects.

In the second part the geography of five inhabited continents as well as of the islands and Antarctica is discussed in the compass of 438 pages. This is accomplished with great success by the adoption of language that is concise

and clear, and above all by the careful choice of the matter to be stated and by a refusal to cumber the book with a plethora of unrelated facts. Indeed, the great value of the work may be said to lie in the sense of proportion which it exhibits, and in the connected and explanatory manner in which phenomena —physical and human—are presented.

A uniform plan is followed in regard to each continent. The general discussion opens with a brief account of exploration, survey, literature, etc., followed by description of structure, relief, and drainage, climate, vegetation, and fauna. The geography of Man is then treated under headings of race and language, religion and material civilization, and concludes with economic and political aspects. The author then takes up successively the various major regions of the continents, his division of these being based now on structure and relief, now on climate and vegetation ; but he never fails to point out how they form real units from the point of view of the "human geographer."

The work is admirably illustrated by 193 figures, mostly small maps of distributions. These are well executed, and would have been even more effective had the book been printed on paper as good as that used in vol. I (1st edit.). These maps, which form a valuable feature, are allocated to eleven subjects amongst others as follows: exploration and map knowledge, 8 ; structure, 14 ; drainage, 5 ; climate, 25 ; vegetation, 7 ; ethnography, 15 ; population density, 10 ; religion and culture, 6 ; politico-historical, 11 ; economic, 8. There are also diagrams representing climatic features of sixty-two stations.

The explanatory nature of the text has been alluded to. But of course scientific investigation has not progressed sufficiently in these continents to permit all observed features and phenomena to be explained with complete certainty. It is a feature of this book that the author has not hesitated to indicate probable causes in these cases, and he has by his language offered sufficient warning to the *careful* reader against too rash acceptance of these explanations. The feature is perhaps most marked in reference to geological structure, to the origins of floras and faunas, and to affinities of races—a subject that receives more attention than in other geographical text-books. In this connection it may be noted that Prof. Hettner does not accept the traces of greater population in the drier parts of Asia in times past as evidence of climatic change. In most cases he finds the abandonment or destruction of irrigation works to be sufficient explanation and—in the Tarim basin—the diversion of water, upstream from the areas in question, for irrigation, coupled with natural changes in the river-beds.

It is difficult to know what to omit from a work of this kind, and omission of detail may be regarded as an evidence of a writer's skill. In the present case there is of course no aspect treated about which some reader will not want to know more ; and it is to Prof. Hettner's credit that such is the case. It appears to the reviewer however that the volume might with advantage have been extended slightly to include : (*a*) rather more description of land forms—particularly regarding degree of dissection, etc.—to enable the reader to visualize landscapes more easily ; (*b*) maps of the continents showing *actual* isotherms ; (*c*) some additional economic information ; (*d*) a brief but systematic bibliography. In regard to economic information, statistical material has necessarily been omitted, but certain facts which would seem to be sufficiently salient to deserve mention do not appear ; for instance, the occurrence of lead and zinc at Broken Hill, Australia, and of manganese in Georgia—both of great importance to these countries and to the World—is

not stated. Bibliographical reference is intentionally restricted to the most outstanding works, with preference to those in German, but the selection of those for mention is somewhat uneven in a number of cases, and frequently only the authors' names are mentioned. A few pages would have sufficed for a valuable regional bibliography.

Picturesque description of course finds no place in this book; and it is better so. Yet the concise statements of salient facts and their causes furnish a frame with unlimited pegs on which the good teacher reading the book may hang the vivid materials culled from many sources. It would seem that none is better qualified than Prof. Hettner to prepare a list of references to passages in other works which might be used in supplement of his own.

A. G. O.

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# THE MONTHLY RECORD

## THE SOCIETY

### The Schools of Geography at Oxford and Cambridge.

FROM their first institution the Society gave financial and other support to the Schools of Geography in the two Universities, being convinced that the improvement of Geographical education in this country was as much its duty as the promotion of discovery and exploration. It was, however, never intended that the financial contribution should be permanent: it was renewed for periods of five years, and finally in 1921, somewhat diminished in amount, it was renewed for a final three years, terminating at Michaelmas 1924. The Council have received from the two Universities letters conveying their thanks for the support thus given to Geographical education, and we hope to publish shortly an account of the Schools now established.

## EUROPE

### Proposed Alsace Canal.

M. J. Levainville contributes a short note on the projected Alsace canal to the *Annales de Géographie* for September 1924. The full importance of the plan will only be realized by reference to a fuller article, "The Economic Function of the Rhine" by the same writer in the *Geographical Review*, April 1924. The value of the Rhine as an international waterway, great though it is, is lessened considerably by its characteristic features between Basle and Strasbourg. The gradient is very steep, 86 cms. per kilometre, while from Strasbourg to Mannheim it is only 35 cms. The current is also fast, averaging more than 10 kms. per hour. At one point, near Istein, a rock ledge causes rapids, and in several places the required depth of 2 metres is maintained only for forty-five days. The German proposal to open up the Swiss markets by a canal system linking the Rhine—Nekar—Danube—Riss to Lake Constance being held up for financial reasons, it is desired to regulate the Rhine between Basle and Strasbourg. The French contend that this is virtually an impossibility, and that in any case it would probably not pay. Other areas besides the Swiss must be tapped, for though Switzerland imports coal, cereals, and iron in large quantities, most of which come up the Rhine, her exports are of lesser bulk, and are distributed by other routes. The suggestion, therefore, is to construct a lateral canal from Basle to Strasbourg. On the left bank of the Rhine the valley with that of the Ill would be broad enough for this purpose. The average fall of the canal would be less than that of the river,

and by taking this course it would tap new areas through the gateways of Belfort and Saverne. It is proposed to build a dam across the Rhine at Huningue, which, besides supplying the necessary water, would act as a safety-valve in time of floods. The fall could be overcome by eight locks, at which power up to 700,000 H.P. could be developed for the surrounding manufacturing regions. The canal would be 120 metres wide, and of an average depth of 6·5 metres. The right of constructing such a canal has been granted to France under the Treaty of Versailles.

**The Rivers of Sweden.**

For the past fifteen years an elaborate series of observations of the flow of the principal rivers of Sweden has been carried out by the Hydrographic Bureau and the Meteorological and Hydrographic Service of Sweden, with the result that we now know as much, perhaps, about the *régime* of these rivers as about those of any other country in the world. A convenient summary of the salient features brought out by the survey, with special reference to the relation between rainfall, evaporation, and run-off, is given by Axel Wallén in the *Geografiska Annaler*, 1924, Häft 1. Of all the rivers the Götaälv takes the lead, both for area of basin and for volume discharged, which amounts on an average to 550 cubic metres per second. Next come the Luleälv, with 500 c.m., the Angermanälv, with 470, and the Indalsälv, with 430. Of the two branches of the Luleälv, the Stora Luleälv is far the more copious. Three other rivers have a mean discharge exceeding 300 c.m. per second, namely the Umeälv, Dalälv, and Torneälv, the respective figures being 390, 360, and 320 c.m. The last named would show a greater discharge were it not for the bifurcation of its tributary the Tärendöalv, which entails a loss to the neighbouring Kalixälv of 80 c.m. Several of the rivers rising in the high mountains of Norrland have a remarkably small discharge, both by reason of the narrowness of their basins and of the relatively small precipitation in the parts of the mountains drained by them. Mr. Wallen brings together in a useful table the data for a number of the rivers as regards area of basin (and of the parts occupied in each case by lakes), the discharge at exceptional and normal floods, at mean stage, and at exceptional and normal low-water stages. It shows that in the upper basins of the high mountain rivers exceptional floods may exceed 200 litres per second per square kilometre of the catchment area, and that in the lower parts they are mostly over 100 litres per km. per sec. The low-water stages vary greatly according to extent of the lakes in the respective basins, the discharge at ordinary low water lying as a rule between 2·5 and 4 litres per km. per sec. The rivers of the forests of Northern Sweden show about the same discharge at ordinary high water, but much smaller ones at the low-water stages. In the rivers of the central plains, the high-water discharge is very great when the basins are poor in lakes, but much less when there are many lakes. In the former case the low-water discharge falls to a very low figure. A second table brings together the data for precipitation, discharge, evaporation, and coefficient of discharge for a number of rivers grouped according to the nature of the country through which they flow, the discharge being reckoned in millimetres of depth of water spread over the surface of the catchment area. In the high mountain tracts this may exceed 1000 mm., and may reach 75 per cent. of the precipitation, while the percentage may fall below 40 in the case of rivers of the plains and forests of Central and Southern Sweden, and those discharging from the great lakes. In the latter part of the paper the author shows the relation between the precipitation and run-off by a series of curves which vary according to the classes of rivers.

## ASIA

### Captain Kingdon Ward's New Expedition in Tibet.

We have recently received from Captain F. Kingdon Ward a short account of the progress of his present expedition into south-eastern Tibet. From this it appears that much previously unknown country has been covered, for though following in part the routes of Captains Morshead and Bailey in their journeys in 1914, the present expedition has in places diverged considerably from them. Captain Kingdon Ward and Earl Cawdor left Kalimpong last March, and after a week's stay at Gyantse took the Lhasa road over the Karo La to the south-west corner of the Yamdrok lake. Leaving the Lhasa road, they skirted the southern shore of the lake and struck north-east over a high pass to the Tsangpo, which they followed down to Tsetang, arriving there on April 21. During the next section of the journey Bailey's route down the Tsangpo to Tsela Dzong was followed, except that at Trap, two days below Tsetang, where there is an impassable gorge, a three days' *détour* was made to the north, whereas Bailey had turned southwards. On this *détour*, which took them through Oga-dzong and over the Lung La, about 17,000 feet, a compass traverse was kept, though no latitudes were obtained as the weather was bad. Tsela Dzong was reached on May 11. Here they remained for three weeks, when they moved their base to Tumbatse, reached by following the Tsangpo down to Temo Gompa, and then crossing the Temo La. During this time preparations were made for mapping the district, and two peaks above Tsela Dzong, one on either side of the Giamda river, had been fixed by re-section from Himalayan peaks, when the rains broke on June 8, a fortnight before they were expected, and prevented further work. Before this, they had noticed to the north of Tsela a range of snow mountains, trending apparently north-west to south-east. Later they hope to fix some of the peaks of these mountains, which they assume to form the Salween–Tsangpo divide. In June they went over the Nyima La, and crossing the Tsangpo at Pe to the Himalayan side ascended the Doshong La. Next month they crossed the Tang La above Tumbatse, and descended the Tsangpo to Gyala, where they crossed and climbed to the Nam La, the most eastern pass over the Himalayas. This pass is occupied by a snowfield feeding a glacier, so that they experienced difficulty in reaching it, and were unable to go down to Pemako. Returning to Gyala, they crossed the Tra La to Tumbatse. This was practically the end of the plant-hunting season, during which fifty species of rhododendron, about forty primulas, and ten poppies, many of them new, had been collected. It was then decided to attempt to reach the Salween. On reaching Tongkyuk the rains began again, and prevented them from joining their survey to the peaks of Namcha. A compass traverse was however kept. Turning west, they crossed a very easy pass—the Nambu La—and found themselves in the snow-capped range seen from Tsela. From the pass they descended to the Pasum (Pasang) lake and marched round it, being unable to find an exit at its head. They then returned to Shoga Dzong, and first turning westwards worked round to the northwards, again finally crossing a pass just under 17,000 feet and descending to the Atsa (Archa) Lake. It was now too late to hope to reach the Salween, so it was decided to return to Tsela *viâ* Gyamda, and then to cross the Temo La to Tumbatse. At the time of writing Captain Kingdon Ward had reached Gyamda. The travellers proposed following the Tsangpo down from Gyala to Gompo Ne, then striking over to Tongkyuk and once more effecting a traverse through the snow range to the Lhasa road at Atsa. Before reaching Lhasa they intend to turn south through Oga-

dzong, regain the Tsang po above Tsetang, and then proceed across the Himalayas to Towang. They hope that on this second journey conditions may be more favourable for observations.

**Russian Central Asia.**

Through the courtesy of the Secretary of State for Foreign Affairs, we are informed that the " National Soviet Republic of Bokhara " has recently become a Socialist republic with the title of " Socialist Soviet Republic of Bokhara," and that a redistribution of Soviet territory in Central Asia has been approved by the Central Executive Committee of Turkestan. This involves the creation of an Uzbeg Republic (Uzbekistan), to include the Uzbegs inhabiting the present Turkestan Republic and Bokhara, of which a Tajik autonomous province will form part; also of a Turkoman Republic (Turkmenistan) to include the Turkomans of the former Transcaspian province, of Bokhara and of Khorezm. The Cossack Kirghiz population, living principally in the Sir Darya province of Turkestan, will be merged in the Kirghiz Republic. A Kara-Kirghiz autonomous province will be formed as a part of the Russian Socialist Federal Soviet Republic.

**Castell Rosso Island.**

The small island of Castell Rosso (or Castellorizo), lying off the south-west coast of Asia Minor, about 80 miles east of Rhodes, has had a long and chequered history. This is clearly and fully dealt with by M. Charles Héderer, from personal knowledge gained during the war, in a pamphlet—'L'Ile du Chateau-rouge'—reprinted from the *Revue Maritime*. The island is about 5 miles long and lies about 2 miles from the coast. It is composed of calcareous massifs, broken by east-to-west depressions, in which most of the villages lie. There are no springs nor wells of pure water; supplies are drawn from the numerous rock cisterns scattered over the island. Neglect of agriculture, through the universal concentration of the islanders upon trade, has led to deforestation and the destruction of the vegetation. The governing factors in the history of Castell Rosso, so called from its reddish cliffs, have been its position commanding the coast-wise trade of Lycia, its harbour, and its relations with Rhodes. In early times it was frequented by the ships of Crete and Phœnicia, and Minoan and Lycian rock sepulchres testify to its importance. A recently opened sarcophagus at St. George was found to contain a gold crown of Mycenian manufacture. On the sites of the castle and acropolis there are Hellenic, Roman, and Byzantine ruins. At Megiste, as it was then called, the Roman fleet and its Rhodian allies concentrated to meet that of Antiochus the Great under the command of Hannibal. During the Middle Ages it was a port for the Crusaders, and later an outpost of Rhodes when that island was held by the Knights of St. John. During the successive struggles between Saracens, Genoese, Neapolitans, Barbary pirates, Spaniards, and Turks the island was repeatedly ravaged. With the capture of Rhodes in 1522, it passed for several centuries into Turkish hands. A Venetian inroad in 1659, when the castle was burnt, ended its mediæval prosperity. During the late war it was held by France, but has now passed to Italy with the Dodecanese.

## AFRICA

**Economic Prospects in Angola.**

A rapid survey of the present conditions and prospects of Angola is contained in an account of a short trip into the interior which we have received from the Department of Overseas Trade. The writer set out from Loanda by

rail, eventually reaching Kassoalala after much delay due to floods. Leaving the railway, he made a motor tour of the interior through Dondo to Bihe, the present terminus of the Benguella railway. This line is very much superior to the Loanda line in organization and in traffic carried, though the difference may not be so great when four variants, shortening considerably the latter line, and a branch through Katete to Kalumbo on the Kwanza, have been completed. It is also proposed to connect these two railways by a line through Kwibala. The climate of the interior plateau was found to be very pleasant. The region of high rainfall in the north is suitable for agriculture, dairy and mixed farming, while the drier southern region is suited for cattle ranching. One of the greatest assets of Angola is said to be the facilities that exist for irrigation. The soil is generally poor, but after being worked, manured, and irrigated, good results are obtained. Maize is the chief crop, but wheat, oats, and rice are grown, as well as oranges, lemons, grape-fruit, etc. With regard to cattle ranching, several large concessions have been obtained already, chiefly by subsidiary companies of States Control, Ltd. (Bovril), but little has yet been done. One farm visited had 750 head of cattle imported from the Cape: they are found to be very liable to pneumonia, though their progeny are less susceptible. One obstacle to stock farming in Angola is the absence of an organized veterinary service. Throughout his tour the writer was particularly struck by the excellence of the motor roads. To encourage their use, a particularly small tax is placed on the import of light cars, and special roads, built by compulsory native labour, are reserved for light motor traffic.

## AMERICA

### Boundaries of the United States.

The revised and enlarged issue of the third edition of 'Boundaries, Areas, Geographic Centres, and Altitudes of the United States and the Several States,' by E. M. Douglas (U.S. Geol. Survey, Bulletin 689, Washington, 1924), contains much detailed yet compact information on the history of United States boundaries not easily obtainable elsewhere. From the first the frontiers of the United States have been the cause of many disputes and much litigation, through faulty geographical knowledge, the absence of well-defined natural frontiers between the various political divisions of the continent, and through loosely drawn treaties. The United States—Canada frontier has a particularly long and intricate history, not being finally delineated until 1910. Its problems were dealt with at some length in the *Journal*, **58**, 432–443. Besides summarizing the main points, this Bulletin contains a half-scale reproduction of the 1774–5 edition of Mitchell's Map of the British and French Dominions in North America, originally published in 1755, which was used in the peace negotiations of 1782–3. There is also a reproduction of part of the map of Mexico, by J. Disturnal, published in New York in 1847, which played an important part in the Guadaloupe–Hidalgo Treaty, 1848, the first Mexican cession treaty. Another plate worth noting is a map of the United States showing the routes of the principal explorers whose work bears upon the settling of the country and its boundaries. The various States of the Union, particularly those of the eastern coast, whose history goes back to the early days of English, Dutch, and French charters, have also had to labour with involved boundary questions. Perhaps the most complicated case was that of Massachusetts. The northern part of the boundary between that State and Rhode Island dates from the charter of 1629 to the Company of Massachusetts Bay, which referred in the south to "all . . . those Landes . . . lying within the space of Three English Myles on the South Parte of the

said River, called Charles River. . . ." In 1642 a stake was set up by Nathaniel Woodward and Solomon Saffrey, which was supposed to mark this spot. The north line of Rhode Island was then agreed upon in 1710 by both States, and was run, inaccurately, in 1719. The eastern portion was fixed in 1741 and run in 1746 by commissioners of Rhode Island, part of their report being as follows: "From a certain point on the Southern side of Pawtucket Falls . . . we run a meridian line, which directly passed through said Falls, to a walnut-tree on the Northerly side of said Falls, then to a pitch pine tree, then to a small white oak, then to a grey oak . . ." Later both boundaries were disputed, Rhode Island declaring that the point adopted as the basis was more than 3 miles south of Charles River. Before the question was settled, in 1881, it was twice taken to the Supreme Court of the United States, and Choate said of it, "The commissioners might as well have decided that the line between the States was bounded on the north by a bramble bush, on the south by a blue jay, on the west by a hive of bees in swarming time, and on the east by five hundred foxes with fire-brands tied to their tails." Considering that the boundary between Massachusetts and Connecticut and New York was also in dispute for some time, it is not surprising to learn that "Massachusetts is one of the very few States that has had her boundary-lines adequately marked and by frequent inspection maintains the marks in good condition."

**Desert California.**

A description, by Mr. J. S. Brown, of that part of California which lies around the Salton Sea, with special reference to its water-supply and conditions of desert travel, has been published as Water-Supply Paper 497, U.S. Geological Survey, Washington, 1923. The area dealt with is about 10,000 square miles situated between the San Jacinto Mountains and the Colorado River, north of the Mexican boundary. The three physiographic regions are these western mountains, the eastern desert basins and ranges, and the Salton Sea basin between. The sea was formed by the Colorado delta cutting off the upper portion of the Gulf of California, the greater part of the detached portion subsequently drying up. There are seventeen drainage systems in the area, but one, the Salton, occupies fifty per cent. of the whole. Sheltered from the rain-bearing winds by the western mountains, the region forms a great closed desert basin, lying at an exceptionally low level. Its centre is generally level, with masses of rocks protruding through the beds of Tertiary sediments and later deposits. Considerable areas are covered by sandhills; one belt east of Imperial valley is 40 miles long and from 2 to 6 miles wide, rising in places to a height of 300 feet. The lower mountain slopes are covered by considerable quantities of alluvium, washed out by storm floods, which shade off into the desert sands. The maximum temperature recorded prior to 1900 was 139° F. The area of greatest rainfall, ranging from 20 inches for places over 3000 feet to 50 inches in exceptional years, lies in the western mountains, one-third of which drains to the Pacific. The precipitation decreases very rapidly down the eastern slopes, and for about five-sixths of the area the annual average is less than 5 inches.

The only permanent streams are found on the slopes of the western mountains, and practically all of them disappear on entering the desert. None are normally of very large flow, but are subject to destructive flooding. In the Coachella valley the damage thus done to good agricultural land has been minimized by dispersing the flood water widely. The water of the Salton Sea, formed recently by the Colorado River breaking through irrigation works, is shrinking rapidly, and is now unfit for consumption. For the supply

of ground water the mountains are the chief contributory areas, and if there is no escape to other basins the area of discharge will be at the lowest part of the valley, where flowing wells may be made by tapping a porous sand bed. The depth to water increases rapidly as the mountains are approached, until finally the bed-rock surface is higher than the water-table. The water will naturally be purest on the alluvial slopes at the foot of the mountains, where it has circulated least. Thus the desert watering-places consist of hillside springs, streams, natural tanks, and artesian springs, besides wells and a few artificial reservoirs. The wild palm, rush, salt grass, and the "running mesquite" are among the indications of water. The latter portion of the book supplies information to travellers on routes, sign-posts, and outfit, concluding with a comprehensive series of "road logs" and detailed description of routes. The accompanying maps are believed to be the most reliable in existence, though sand-storms and other local occurrences make it impossible to show every road and well definitively.

## MATHEMATICAL AND PHYSICAL GEOGRAPHY

### Ice and Currents in the North Atlantic.

A detailed account of the work of the International Ice Patrol in the North Atlantic during 1923 is given in a report of the "International Ice Observation and Ice Patrol service" (Treasury Department: U.S. Coast Guard, Bulletin No. 11, Washington, 1924). The patrol was maintained by the U.S. Coast-guard cutters *Tampa* and *Modoc* between March 13 and July 12 off the Grand Bank. Exceedingly stormy weather was experienced during March. Water temperatures showed that the Labrador Current had assumed an unusual south-easterly drift, which was also shown by the drift of numerous bergs as far east as the steamer tracks to northern European ports between 44° and 46° N. Field ice was reported further south than usual, and steamer tracks were shifted 60 miles to the south. By the middle of April the easterly drift of bergs before reaching the Tail of the Bank ceased; the subsequent drift was round the Tail and then to the north-west, and this continued to be the rule during May. The first vessel from the St. Lawrence ports came through on May 14. Fog and low visibility prevailed particularly during June, but the bergs sighted constituted no real menace to the normal steamer tracks. During the season, 46 vessels were warned of the proximity of ice, 195 were furnished with special ice information, and approximately 8500 water temperature reports and 416 reports of the sighting of ice were received. Important oceanographic work was also carried out, and by disclosing the presence of polar water over a large area, the observations permitted a forecast to be made of the probable drift of the bergs up the south-west slope of the Bank. During the season 103 oceanographical stations were occupied. The results showed (1) on the east of the Bank an intrusive shoulder of the Gulf Stream and an offshore movement to south-flowing waters, accounting for the movement of bergs noted above; (2) a variation in size and velocity of the Labrador Current, which became weak and attenuated on May 27-30, though voluminous and flowing at record strength on April 13–14; (3) a movement of Arctic water westward along the south-west slope of the Bank; (4) a tendency of the Labrador Current to spread in on the bottom of the Bank, and a progressive freshening and warming over the centre of the Bank with the advance of the season. Another cruise in October showed that the northern water around the Tail, very shallow and narrow as compared with June, had warmed by 1° and become salter by 8 per cent. since the spring; and that a seasonable variation in the current from the north exists.

**Surface Temperature of Deserts.**

The subject of the relation of desert plants and animals to their physical environment is of considerable interest, but has hitherto been less carefully studied than it deserves to be. A step in advance was recently made by the publication of Mr. P. A. Buxton's 'Animal Life in Deserts,' reviewed in the *Journal* for February 1924, p. 165. This writer is continuing his researches, and in the *Journal of Ecology*, vol. **12**, No. 1 (January 1924) gives the results of observations made by him in Palestine on the daily range of temperature and the maxima reached on the actual surface of desert soils, factors which must obviously be of great importance to the plant and animal life occurring thereon. Such observations are difficult by reason of the excessively thin layer of soil subject to such maximum temperature, as proved by the results of Mr. Buxton's observations, and a good part of the paper is taken up with a discussion of the most suitable means of ascertaining the surface temperature. Hitherto observers have been generally content to determine the temperature at a slight depth below the surface, the most superficial record obtained by Williams in Wadi Digla, near Cairo, being from a depth of 1 cm. Even Sinclair's record of 71·5° C. from 0·4 cm. below the surface obtained at the Desert Laboratory at Tucson, Arizona, may probably correspond to a surface temperature of about 80° C. (176° F.), as indicated by plotting the curve for the values obtained at varying depths. Mr. Buxton's own observations near Jerusalem showed a remarkable difference between the surface temperature (50·5° C.) and that at 1 cm. (44·5° C.). If the surface layer is soft the temperature may be found approximately by laying a small mercury thermometer on it and sprinkling it with dust or sand, but this method is quite untrustworthy if the surface is hard (solid rock or pebbles). In the latter case Mr. Buxton recommends dropping upon the surface shavings of paraffin waxes of varying melting-points, a method suggested to him by Mr. G. I. Taylor, F.R.S. The results of his observations show that the surface of Palestine reaches a midday temperature of about 55–62° C. in June and July, but that great differences may be observed in places only a few yards apart, owing to reflected radiant heat, and differences in the inclination of the surface. The high temperatures recorded are of interest to the biologist in view of the fact that insects may be found squatting on the surface of bare desert even at midday in summer, and that seeds of desert annuals must be exposed to such temperatures every day for months on end.

## CORRESPONDENCE

### "More Talk about Hannibal."

MR. TORR begins his protest against my criticism of his recent treatise on 'Hannibal's March through the Alps' by quoting an alleged remark made by Napoleon. This was rash on his part, for it has reminded me of a written verdict given by Napoleon when at St. Helena on the Crossing of the Rhône, a verdict altogether adverse to Mr. Torr's conjectures. I quote it as translated by Mr. Spenser Wilkinson:

"Hannibal crossed the Rhône above its confluence with the Durance and below its confluence with the Ardèche. He passed above the confluence of the Durance because he did not wish to direct his march upon the Var: he passed below the confluence of the Ardèche because there commences the chain of mountains which almost precipitously commands the right bank of the Rhône as far as Lyons, while the valley on the left bank is several leagues wide. From

the mouth of the Rhône to the confluence with the Ardèche is twenty-eight leagues ; it is probable that Hannibal crossed four leagues lower down at the level of Orange, twenty-four leagues or four days' march from the sea "—that is at Roquemaure.

I am very reluctant to inflict on the readers of this *Journal* any further notes on Hannibal's Pass, a subject which has little interest except for historical students and Alpine geographers. But I cannot allow the various assumptions and assertions embedded or implied in Mr. Cecil Torr's protest against my Review of his recent work to pass unchallenged and uncorrected. I shall, therefore, endeavour to deal with them in order and as concisely as may prove possible.

First, as regards the spirit in which we should approach the texts of Polybius and Livy. Here further discussion with Mr. Torr would, I fear, be fruitless. Our points of view are incompatible. An accurate scholar, he looks on the texts of the classical authors with a curiously uncritical reverence. He follows unhesitatingly the story they tell in its minutest details—except, of course, when they contradict themselves, or one another. To the best of my judgement this is not the way to get at what actually occurred. Polybius and Livy were, I incline to believe, like many historians, artists as well as chroniclers. The judicious student must make reasonable allowance for the atmosphere of the age in which they lived and of the public for whom they wrote. He will bear in mind the general tendency of historians to fail in accuracy and to exaggerate when dealing with topographical details. In this particular case of Hannibal's Passage of the Alps he will overlook neither the far more serious obstacles offered by mountains before they were provided with roads, nor the impression created by snow and crags on minds unused to the sterner aspects of Nature—one very different from that they produce on the modern tourist. I have, I hope, a proper respect for Polybius' narrative as a whole, but I cannot bring myself to accept with any confidence the verbal accuracy of the reports of the speeches he frequently inserts in his pages.

Further, as I wrote in September, Hannibal, if he made any speech on the top of the Alps—an inconvenient platform !—is far more likely to have appealed to the imagination of his followers than to have confined himself to a description of the view immediately before their eyes.

Again, I would remind Mr. Torr that in refusing to agree to the necessity of a Pass with a View I am not, as he suggests, taking up a solitary, or even an unusual, standpoint. It is one necessarily shared by the crowd of eminent historians and geographers who have conducted Hannibal either over the Little St. Bernard, the Mont Cenis, or the Mont Genèvre. I would further remind him that Mr. W. T. Arnold, in his notes to his grandfather's ' Chapters on the Second Punic War ' (1886), has summarized the discordant, but as a rule depreciatory, views of great historians, both English and German, as to Polybius' qualities as a geographer.

Now as to the character of the Col de la Traversette and its capacity for providing camping-grounds : I have on this point the advantage of the testimony of M. H. Ferrand, of the Grenoble bar, a well-known writer of books and treatises on the Western Alps, who sends me his personal impressions, illustrated by a photograph of the Pass, reproduced in the *Alpine Journal*, No. 229.

He writes, with French vivacity, " Comme vous le faites ressortir c'est certainement une des brèches les plus escarpées des Alpes avec des pentes exagérées sur les deux versants. Je me permets de vous en adresser une vue qui rend bien sensible cette quasi-verticalité de chaque côté. Entre la hauteur

du tunnel et le sommet du col le mot de *Mur* n'a rien d'exagéré. . . . N'est ce pas qu'il est amusant de voir discuter cette question par des écrivains qui ne connaissent pas les Alpes. Si un avion providentiel transportait M. Torr sur le Col de la Traversette il frémirait de l'impossibilité de sa prétention."

M. Ferrand goes on to point out that if Hannibal was led up the valley of the Guil he had from its head a choice of several passes to Italy, all easier than the Traversette, which was only tunnelled (in 1480) and brought into use owing to the need of a direct communication between the Marquisate of Saluzzo and Dauphiné.

To Mr. Torr's next objection I reply that if he will take the trouble to turn to my 'Hannibal Once More,' he will find that there is no such inconsistency as he alleges in my argument. The slopes of the approaches to the Col de l'Argentière are generally gentle, but they are interrupted by the precipitous but short defiles of the Pas de la Reysole and the Barricades at a distance on either side of the watershed that fits in very well with the classical narratives.

As to another point raised, whether Polybius wrote "being at a camp about four days distant from the sea" or "being about four days distant from the camp by the sea," Mr. Torr's correction in no way affects the main argument. We learn elsewhere that Scipio took four days in marching hastily from his camp by the sea to the Crossing. Is it not far more likely that Polybius, when he wrote the passage quoted, had in his mind the point on the seashore where Scipio was camped rather than, as Mr. Torr suggests, some otherwise unmentioned spot on Hannibal's track from Spain? Mr. Torr's attempt to throw doubt on the location of Scipio's camp at the spot afterwards known as Fos seems groundless as well as beside the mark. The hill of Fos must have been the landing-place at the eastern mouth of the Rhône long before it gained its name from the canal dug by Marius with the object of making Arles a seaport. See Bullock Hall's 'Romans on the Riviera' (1898), where a drawing of Fos is given.

Polybius says the Rhône rises north of the head of the Adriatic and flows into the Sardinian Sea. Its general course therefore was in his view east to west. He adds, it is true, that it flows "towards the winter sunsets," implying a bend southwards. But he also says that it has the Kelts to the north and the Alps to the south of its course. He is clearly not particular or consistent as to the points of the compass.

As to the identification of the Island with the region between the Rhône and the Isère rather than with that north of the Durance, my own conviction is based on frequent visits to the districts in question and my lifelong experience as an Alpine traveller and geographer. I am content to leave its relative value as compared to Mr. Torr's bold contradiction to the judgement of the Fellows of this Society and any other competent critics. It is however right to point out that my verdict is not singular or even exceptional, but identical with that of all the famous historians who have in times past accepted either the Little St. Bernard or the Mont Cenis as Hannibal's Pass. With regard to the uncertain and probably shifting location of the mountain tribes I refer Mr. Torr to what I wrote in 'Hannibal Once More.'

I come next to Mr. Torr's references to Livy. Here, I must confess, in more than one instance he fairly bewilders me. Mr. Torr does not contest Livy's definite statement that Hannibal reached the Crossing in four days from the Confluence. Yet he repeatedly suggests that having found Scoras, a word nowhere else known as a river name in classical literature, in the text of Polybius, Livy read it, or mistook it, for Saucona and identified it with the

Saône. This hazardous guess involves Livy in a crude contradiction. For he had asserted that the Crossing and the Confluence were four days' march apart, while the junction of the Rhône and the Saône—Lyons—is 140 miles from the upper Crossing at Roquemaure and 170 miles from the lower Crossing at Beaucaire, which Mr. Torr favours. I find it easier to believe that "Scoras" is a copyist's blunder, than that Livy stultified himself so recklessly.

Again, I wrote in September, "Mr. Torr asks us to believe that Livy was mistaken in suggesting that it was fear of a flank attack that induced Hannibal to avoid marching along the river Durance and persuaded him to retreat further north." I referred to a sentence in section 67 of Mr. Torr's book, which runs, "There is nothing in the argument that Hannibal would not venture to march along the Durance, as the Romans might attack him on the flank. In the first place, there were no Romans there." Now Hannibal, as I showed in my review, could not have known of the Roman withdrawal at the date on which he started upstream from the Crossing. Mr. Torr's last sentence is therefore misleading, and he now contends that Livy does not suggest that Hannibal withdrew to avoid a flank attack (*Geog. Journ.*, **64**, p. 430). Yet here are Livy's words: "Postero die profectus adversâ Rhodani ripâ mediterranea Galliæ petit, non quia rectior ad Alpes via esset, sed quantum a mare recessisset minus obvium fore Romanum credens"—the further he got from the sea the less the Romans would be on his path.

In Section 42 of Mr. Torr's recent book I found a reference to the floods of the Durance which suggested to me that he did not realize that these floods mainly originate in its very wide upper catchment basin, so that when in spate it may be as difficult to cross in its middle course as "a long way further down nearer its confluence with the Rhône."

Again, I cannot see that any comparison can fairly be made between my acceptance of the, at least, plausible emendations of Livy's river names, which have been adopted by his most eminent editors and are incorporated in the standard texts, and Mr. Torr's summary dismissal as interpolations of the sentences in Strabo and Varro (*diligentissimus investigator antiquitatis*, as Cicero called him) which he finds inconvenient to his argument. At any rate, such an attitude closes any prospect of further useful discussion between us.

There are other excursions and divagations in Mr. Torr's recent contributions to Hannibalian literature that I might comment on. But I have already occupied too much space. I will only ask him, should he again have occasion to refer to the average length of Roman marches at the time of the Punic Wars, to consider and explain the definite statement made by Polybius that a large part of Sempronius' army—before the battle of the Trebia—marched from Lilybæum (Marsala) through Rome to Ravenna in forty days. The distance is some 750 miles, and the troops must therefore, if the statement, which Dr. Arnold accepts, proves to hold good, have marched little less than 20 miles a day.

I trust I may have no further call to intervene in a discussion into which I have been drawn reluctantly. May I venture, in conclusion, to express my hope that Mr. Torr, in any further contributions that he may make towards the solution of this ancient riddle, will recognize that—if I may borrow a phrase he favours—it is unwise to assume that his predecessors in the game have been for the most part "silly men"!

There are two small errors in my September review at the top of page 242: 380 feet should be 115 feet, and in the next line 246 yards should be 246 feet.

DOUGLAS W. FRESHFIELD.

## MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1924-1925

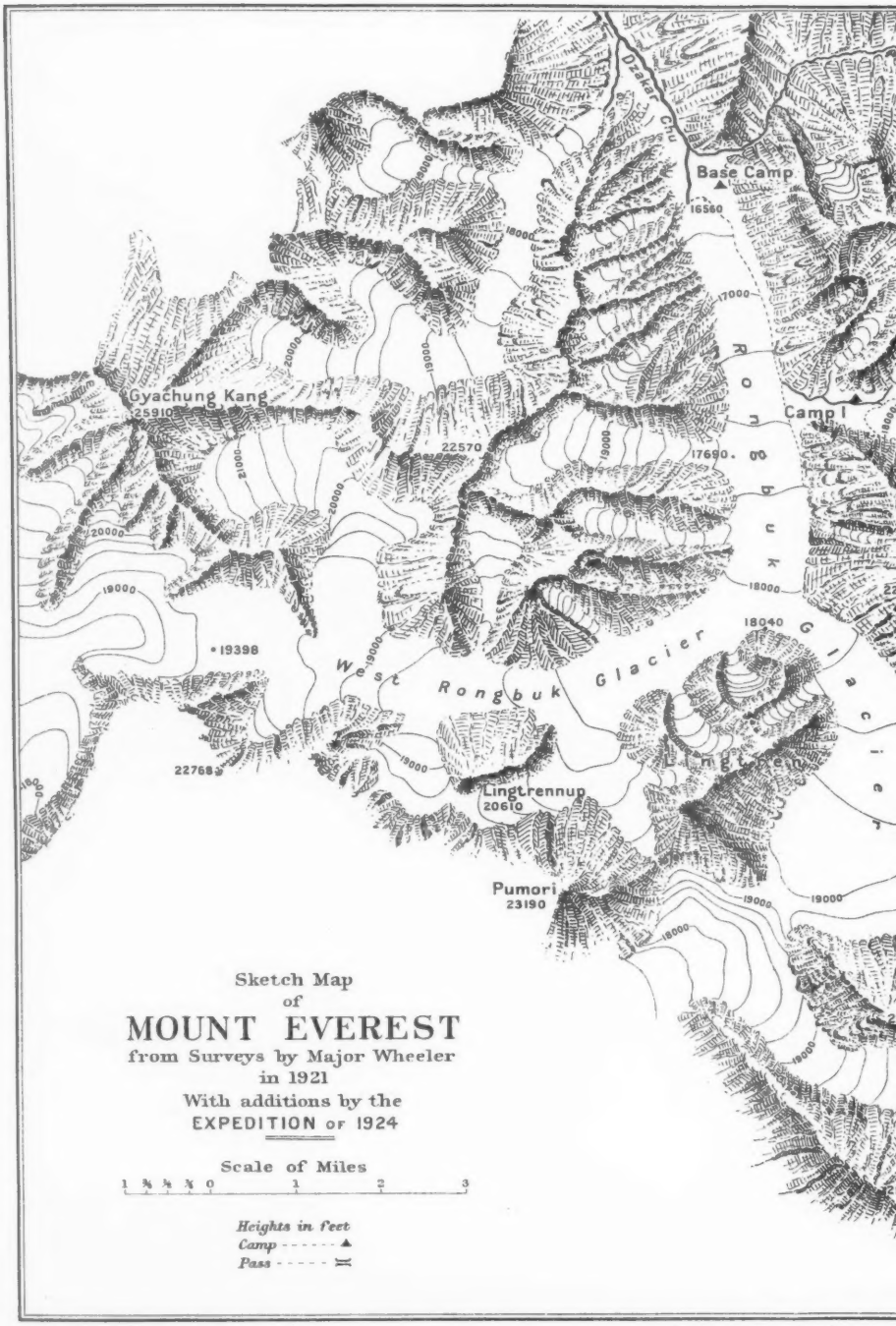
**First Evening Meeting, 3 November 1924.**—The President in the Chair.

ELECTIONS.—Major Wilfred Stuart Akers, O.B.E.; Michael Francis Albert; Percy Appleyard, F.L.S.; Arthur William Bainton, B.A.; Enoch Bernstein, PH.D.; Miss Ada M. Boyland; Patrick Grant Boyle; John Francis Eustace Brake; C. G. Brasher; Col. Sir Edward Allen Brotherton, Bart., LL.D., J.P.; Capt. J. C. C. Bullock; Henry Gould Busk, M.A.; Mrs. Margaret Cameron; David Catt; Capt. Francis Oswin Cave, M.C.; Henry James Channon; Mrs. Eleanor C. Charlesworth; A. J. Cheong; Major Thomas Ford Chipp, M.C., B.SC., PH.D., F.L.S.; Thomas Alexander Clark, M.I.MECH.E.; Patrick Andrew Clayton; Nicholas Clements. B.SC.; H. G. Clogstoun, C.I.E.; Cyril Clement Cooper; Mrs. Violet Laura Caroline Cotton; Bomanjee Cowasjee; H. Czarnikow; Lieut. George Henry Curtis Dale, A.E.C.; Ernest Samuel Darke; Arthur Henry Davies; Miss Florence J. Pinder Davis; Arthur Stanley Dean; Mrs. R. L. Devonshire; Matthewman Henry Donald, M.A.; William Robert Dunlop; The Lady Dynevor; Mrs. A. Ellert; Charles T. Evennett; Neil John Constable Farmer, A.M.I.C.E.; Miss Charlotte Melaine Forbes; Sir Herbert George Fordham; Dr. Thomas William Francis Gann, J.P., M.R.C.S., M.R.C.P.; Lieut. C. W. T. Garrett, R.N. (Rtd.); Stanley T. Gaywood; H. W. C. Gill; D. A. Grant; F. Leroy Granville; N. Greenwood, B.A.; P. F. Hadow; Squadron-Leader E. Harrison, R.A.F.; Mrs. B. F. Hassall; Mrs. J. E. Heaton; Van Campen Heilner; Hassan Heshmat, Bey; Capt. F. E. Hill; Group-Capt. F. V. Holt, C.M.G., D.S.O., R.A.F.; A. E. Holton; H. Howse; J. H. Hunt; Chūji Inomata; D. Jackson; R. Frier Jardine; D. S. Jennings, F.S.I.; Miss F. S. Johnson; C. H. Karius, J.P.; B. L. V. Kay, M.A.; Rev. C. S. King; Lieut. K. Woodburn Kirby, R.N.; Capt. S. Woodburn Kirby, R.E.; C. L. M. Langham; A. E. Laurence; Hon. Chee Lee; Sir P. Loraine, Bart., C.M.G.; Capt. A. D. Macdonald, M.C.; Rev. G. H. McNeal, M.A.; E. H. Marshall; J. Wood Massey; J. Maudslay; L. S. Mayne; Miss C. F. Mitchell, B.A.; T. St. Patrick Molony; Miss E Morgan; J. W. Morgan; Mrs. Morrison; H. Mynors-Smith, A.C.P.; Surgeon Lieut.-Commr. R. P. Ninnis, M.B., B.S., R.N.; A. Noxon; Lieut.-Col. C. B. Palmer, C.B.E., M.I.MECH.E.; F. W. A. Prideaux, O.B.E.; H. Quarmby; J. Quinn, M.C.; Mrs. E. Raphael; A. Rapp; Miss A. E. Rawson; Flight-Lieut. G. S. Reed, O.B.E., R.A.F.; E. C. M. Roberts; Harold Roberts; J. Elliott Robson; R. Rodger; H. T. Rogers; Rev. Dr. F. Rolt-Wheeler; H. G. W. Romer; H.H. The Ranee of Sarawak; W. Scorer; Flight-Lieut. H. S. Scroggs, R.A.F.; Miss F. C. Sears, B.A.; A. H. N. Sewell, M.A.; W. Shaw; Keizo Shibusawa; E. Silas; Miss C. Skurray; T. J. Slee; H. M. Smith; T. J. Southern; Lieut.-Col. H. Spencer, O.B.E.; Lieut. F. H. A. Stables, I.A.; J. F. Stedman; Rev. E. M. Strong, M.A., O.B.E.; Major A. N. Tasker (Medical Corps, U.S. Army); C. B. Ticehurst, M.D., M.A.; A. C. Tunstall, B.SC.; H. Upcott, F.R.C.S.; Miss F. Walker; G. F. Wallis; T. H. Walmsley; G. F. Walpole, B.A.I.; Major C. L. A. Ward-Jackson; J. R. Whitwell, M.B.; Major R. S. Wickham; Dr. J. H. Williams, M.P.; Capt. O. Williams, B.A.; Capt. B. H. Withers; E. M. Woodman, M.S., F.R.C.S., F.R.C.P.; J. M. Wormald.

PAPER: Innermost Asia: its Geography as a Factor in History. Sir Aurel Stein.

**First Afternoon Meeting, 10 November 1924.**—The President in the Chair.

PAPER: Physiological difficulties in the Ascent of Mount Everest. Majo R. W. G. Hingston.

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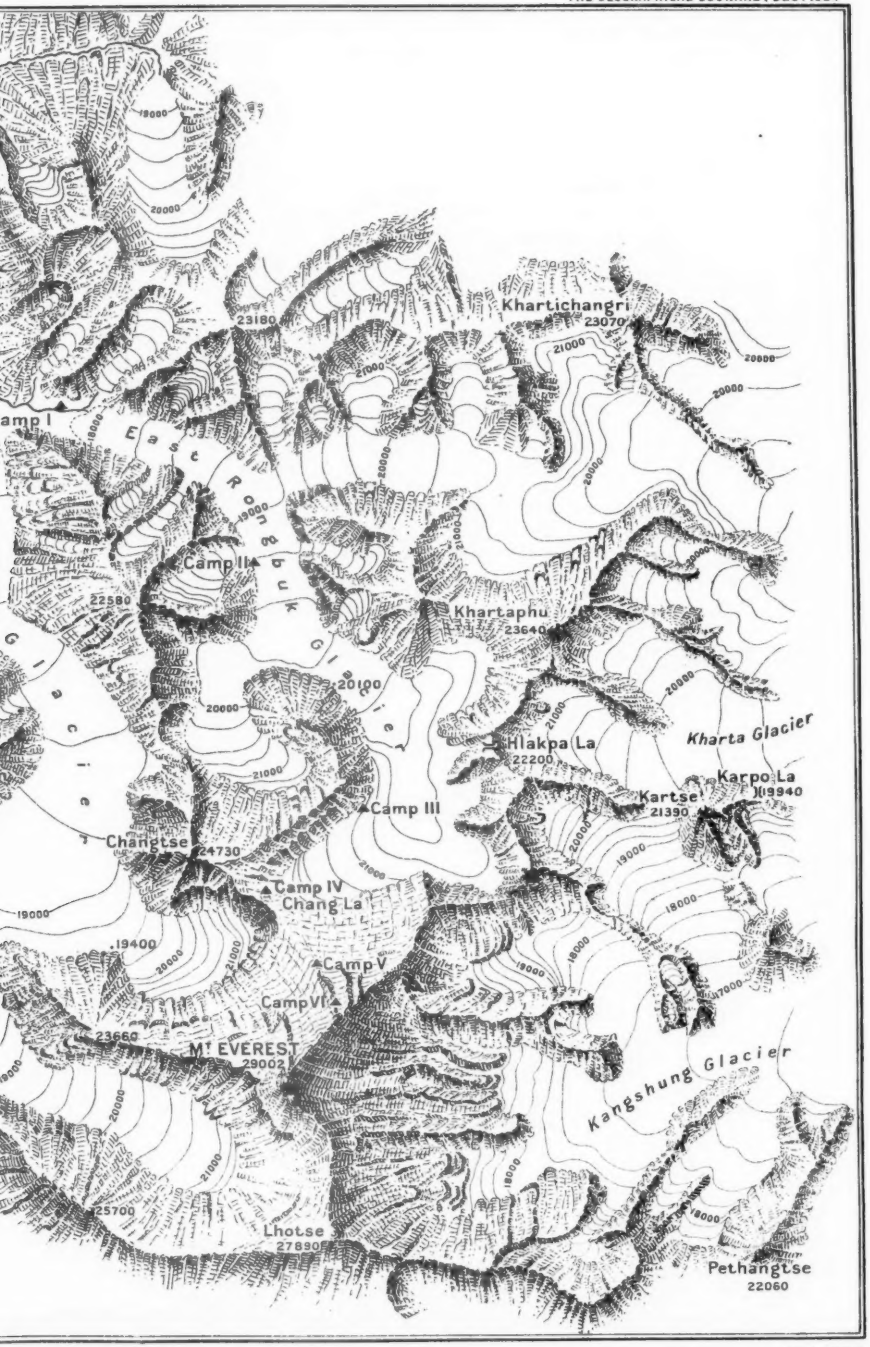


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